National Weather Service Advanced Storm Spotter Training

Kelly Godsey

Assistant Warning Coordination Meteorologist

NWS-Tallahassee

Presentation Topics

- Review of Basic Spotter Training
- Meteorological Principles of Convection
- Severe Weather Forecasting
- Thunderstorm common to the Southeast
- Radar Basics
- Another look at wall clouds / tornadoes / shelf clouds
- A closer look at a severe weather event
- Weather Safety

Your National Weather Service

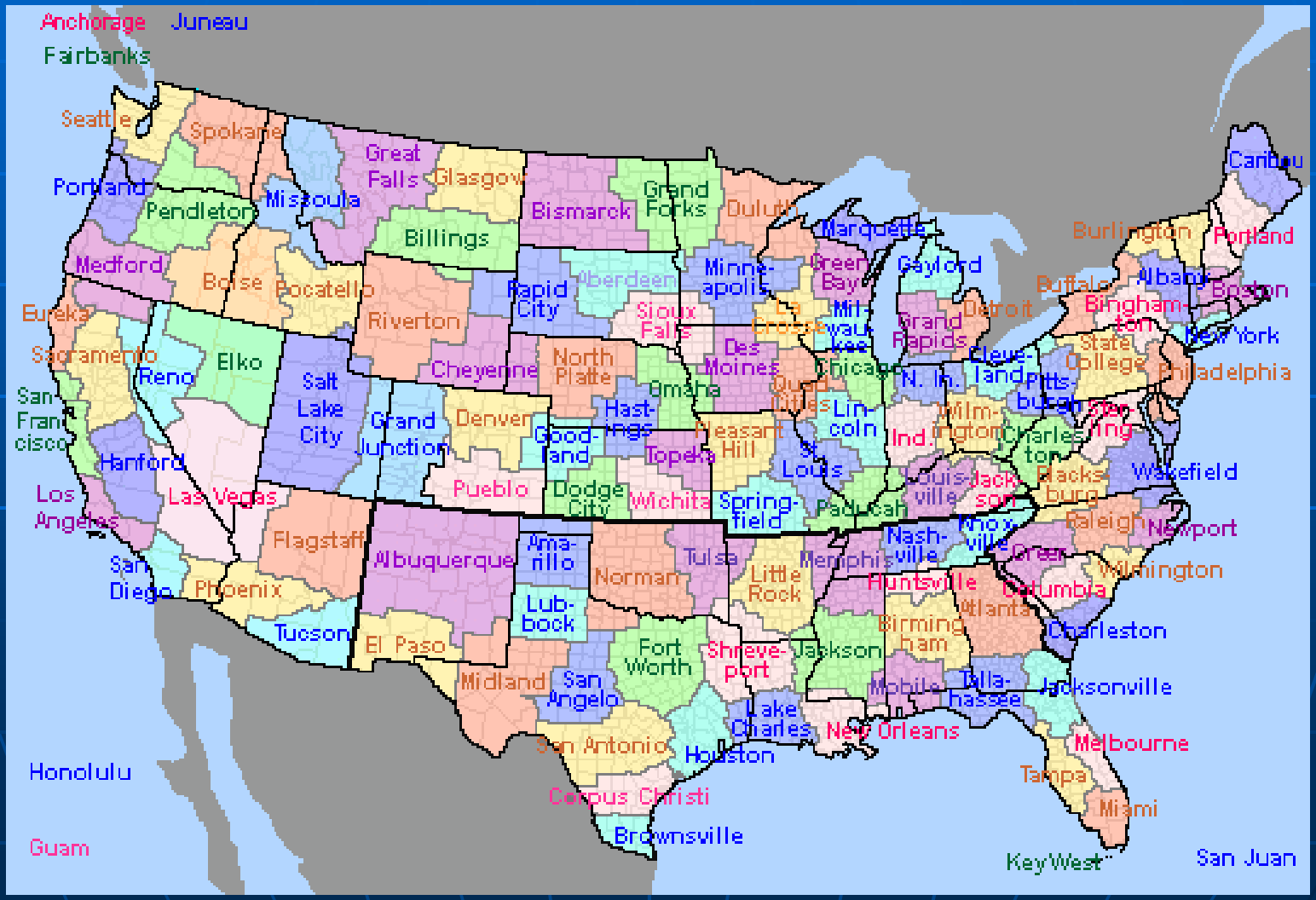
The National Weather Service (NWS) is part of the National Oceanic & Atmospheric Administration (NOAA), which is within the Department of Commerce.

Our mission: The NWS provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which is used by other governmental agencies, the private sector, the public, and the global community.

www.noaa.gov

www.weather.gov

Your source for official weather information
123 offices serving America & surrounding territories



National Weather Service county warning areas

Sources of Weather Information

- **NOAA Weather Radio** - Your fastest link to vital information 24 hours/day
  - www.weather.gov/nwr
- **The Internet** - Your official source for reliable and accurate weather information
  - www.weather.gov
- **EMWIN** - Emergency Management Weather Information Network
  - A suite of data access methods which make available a live stream of weather and other critical emergency information
  - http://iwin.nws.noaa.gov/emwin/index.html
- **Commercial or cable television** – You can tune to your local or cable TV station to receive National Weather Service watches/warnings/advisories
- **Commercial radio** – LP1 stations broadcast all tornado, severe thunderstorm, and flash flood warnings.

National Weather Service Weather Forecast Office

Tallahassee, FL

weather.gov

Home | Site Map | News | Organization | Search for: NWS All NOAA Go

Local forecast by "City, St" or Zip Code

City, St Go

XML RSS Feeds

- Current Hazards
  - Local
  - Nationwide
  - Outlooks
  - Graphical
  - Storm Reports
  - Past Events
- Forecasts
  - Local
  - Forecast Discussion
  - Activity Planner
  - Graphical
  - Tropical Weather
  - Fire Weather
  - Aviation Weather
  - Marine Weather
- Current Weather
  - Observations
  - Satellite Images
  - Rivers/Lakes
  - Precip Estimates
  - Hydrology
  - Marine Observations
  - Florida Weather
  - Georgia Weather
  - Alabama Weather
- Radar Imagery
  - Nationwide
  - Local Radars
- Climate
  - Local
  - National

Top News of the Day

- The 2009-10 Winter Season Was One of the Coldest & Wettest on Record
- Local Spring Flood Potential Outlook
- Changes to NWS Hydrologic Services Web Pages
- WFO Tallahassee Zone Changes

Watches & Warnings | Observations | Forecast Graphics | Rivers & Lakes | Climate | Graphicast

Click on the map below for the latest forecast.

Last map update: Tue, Mar. 9, 2010 at 11:35:00 am EST

Read watches, warnings & advisories

Zoom Out

Flood Warning

Hazardous Weather Outlook

Latest Conditions in Tallahassee, FL

Mar 9
10:53 am

Mostly Cloudy

60°F
(16°C)

Choose Your Front Page City

Select A City:

Graphical Forecasts | Radar | Satellite | Weather Map

Your Official Weather Source

Your National Weather Service forecast

Tallahassee FL

Enter Your "City, ST" or zip code Go BOOKMARK

NWS Tallahassee, FL
Point Forecast: Tallahassee FL
30.47°N 84.25°W (Elev. 98 ft)

Mobile Weather Information | En Español
Last Update: 10:08 am EST Mar 9, 2010
Forecast Valid: 12pm EST Mar 9, 2010-6pm EDT Mar 15, 2010

Forecast at a Glance

This Afternoon	Tonight	Wednesday	Wednesday Night	Thursday	Thursday Night	Friday	Friday Night	Saturday
 30%	 40%	 60%	 80%	 70%	 50%	 50%	 20%	
Chance Showers	Chance Rain	Tstms Likely	Showers	Tstms Likely	Chance Rain	Chance Rain	Slight Chc Showers	Partly Sunny
Hi 67 °F	Lo 49 °F	Hi 72 °F	Lo 57 °F	Hi 75 °F	Lo 58 °F	Hi 76 °F	Lo 49 °F	Hi 68 °F

Detailed 7-day Forecast

This Afternoon: A 30 percent chance of showers. Mostly cloudy, with a high near 67. South southeast wind around 10 mph.

Tonight: A 40 percent chance of rain after 1am. Cloudy, with a low around 49. South southeast wind around 5 mph.

Wednesday: Rain likely, with thunderstorms also possible after 1pm. Cloudy, with a high near 72. South southeast wind between 5 and 15 mph. Chance of precipitation is 60%. New rainfall amounts between a tenth and quarter of an inch, except higher amounts possible in thunderstorms.

Wednesday Night: Showers and possibly a thunderstorm. Low around 57. South southeast wind between 10 and 15 mph. Chance of precipitation is 80%.

Thursday: Showers likely and possibly a thunderstorm before 1pm, then a chance of showers and thunderstorms

Current Conditions [Move Down]

view Yesterday's Weather

Tallahassee Regional Airport
Lat: 30.4 Lon: -84.35 Elev: 69
Last Update on Mar 9, 10:53 am EST

Mostly Cloudy

60 °F (16 °C)

Humidity:	56 %
Wind Speed:	E 5 MPH
Barometer:	30.09" (1018.6 mb)
Dewpoint:	44 °F (7 °C)
Visibility:	10.00 mi.

More Local Wx: 3 Day History:

Radar and Satellite Images

County Specific Information:

* Hazardous Weather Outlook

*Watches

*Warnings

* Severe Weather Statements

*Short Term Forecasts

NOAA ALL Hazards Weather Radio

http://www.srh.noaa.gov/tae/nwr.php

Broadcasts are found in the public service band at these seven broadcast frequencies (MHz):

162.400 MHz	162.425 MHz	162.450 MHz	162.475 MHz	162.500 MHz	162.525 MHz	162.550 MHz

NOAA Weather Radio

Important Definitions

- **Watch** - Atmospheric conditions are favorable (or could become favorable) for the development of thunderstorms which could produce severe weather – remain alert.
- **Warning** - Severe weather has occurred or is likely to occur – take protective action.

Tornado Warning Criteria

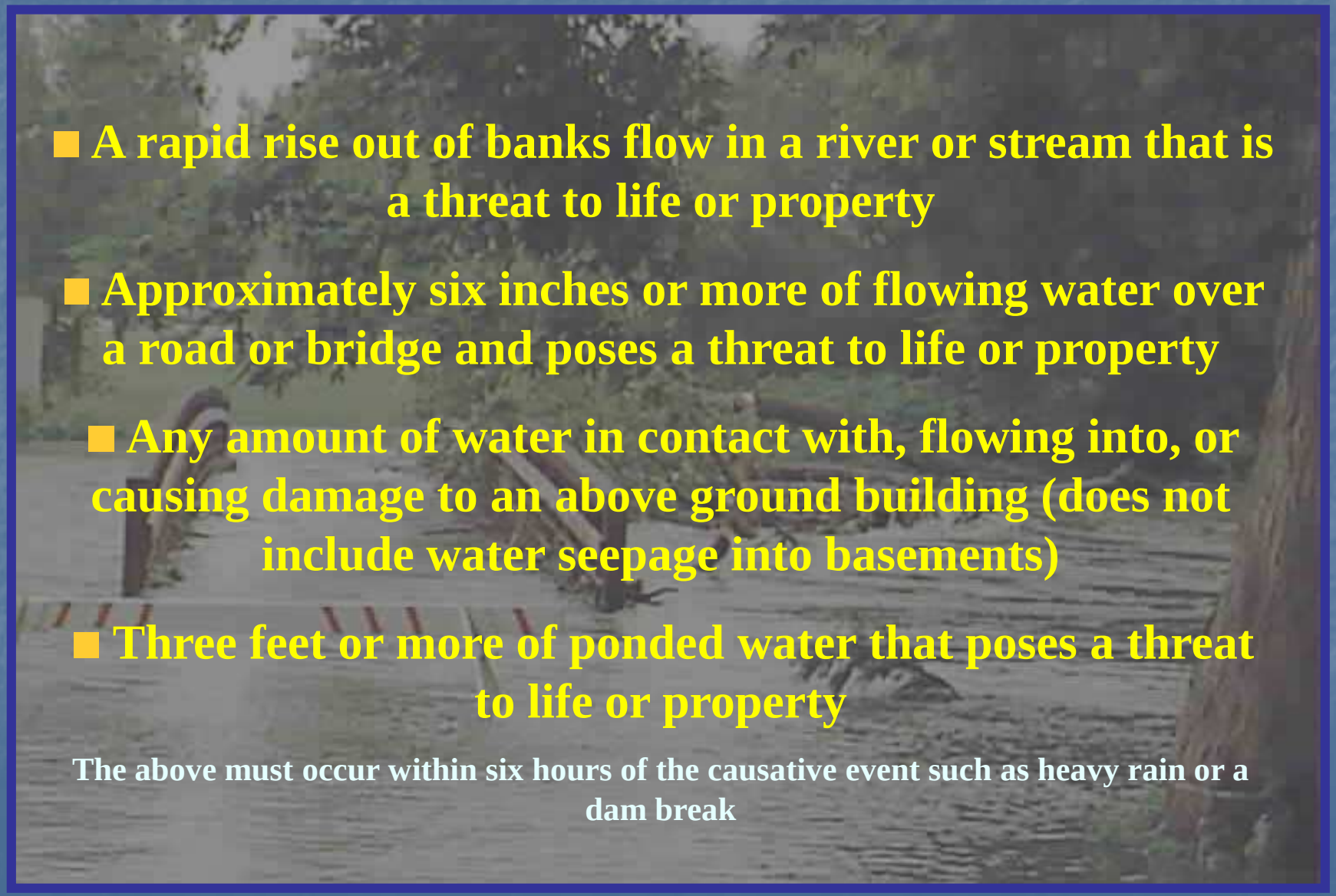
A tornado is occurring, a verified funnel cloud is reported and the NWS believes it could develop on the ground, or radar indicates a thunderstorm capable of producing a tornado.

Severe Thunderstorm Criteria

wind 58 mph or greater

1 inch or larger hail

Flash Flood Warning Criteria



- A rapid rise out of banks flow in a river or stream that is a threat to life or property
- Approximately six inches or more of flowing water over a road or bridge and poses a threat to life or property
- Any amount of water in contact with, flowing into, or causing damage to an above ground building (does not include water seepage into basements)
- Three feet or more of ponded water that poses a threat to life or property

The above must occur within six hours of the causative event such as heavy rain or a dam break

The Effective Spotter Report

- **Call your NWS office via phone 800-598-4562 or 850-942-8833**
- **State source of report (your identity, i.e. trained spotter)**
- **Give your exact location (and location relative to the event)**
- **State the start & end time of the event (be sure to differentiate between *event* time & *report* time)**
- **Give an event description (be as specific and detailed as possible)**
- **If event is still occurring, provide frequent updates**
- **Give as reliable information as possible. Do not embellish**

What To Report

Tornado, Funnel Cloud, or Wall Cloud

What To Report

Strong or Damaging Wind

What To Report

Hail

What To Report

What To Report

Any Storm Damage

What To Report

Urban Flooding

What To Report

Rural Flooding

What To Report

Past Water/Flood Damage

What Makes a Good Report?

Caller #1: "I was just calling to report that a severe thunderstorm just moved through my neighborhood. It was windy and there was lots of lightning and heavy rain."

Caller #2: "We just had a severe thunderstorm move through our neighborhood in Thomasville. We have several large trees down in the road and I also see quarter size hail on the ground."

One of these reports is better than the other. Why?

What Makes a Good Report?

Caller #1: "I was looking out my window toward the south and I saw a tornado. The clouds were really dark and hanging near the ground."

Caller #2: "We definitely had a funnel cloud move overhead. You could see the cloud base rotating with a funnel extending down. It wasn't on the ground yet. I lost sight of it a few minutes ago."

One of these reports is better than the other. Why?

What Makes a Good Report?

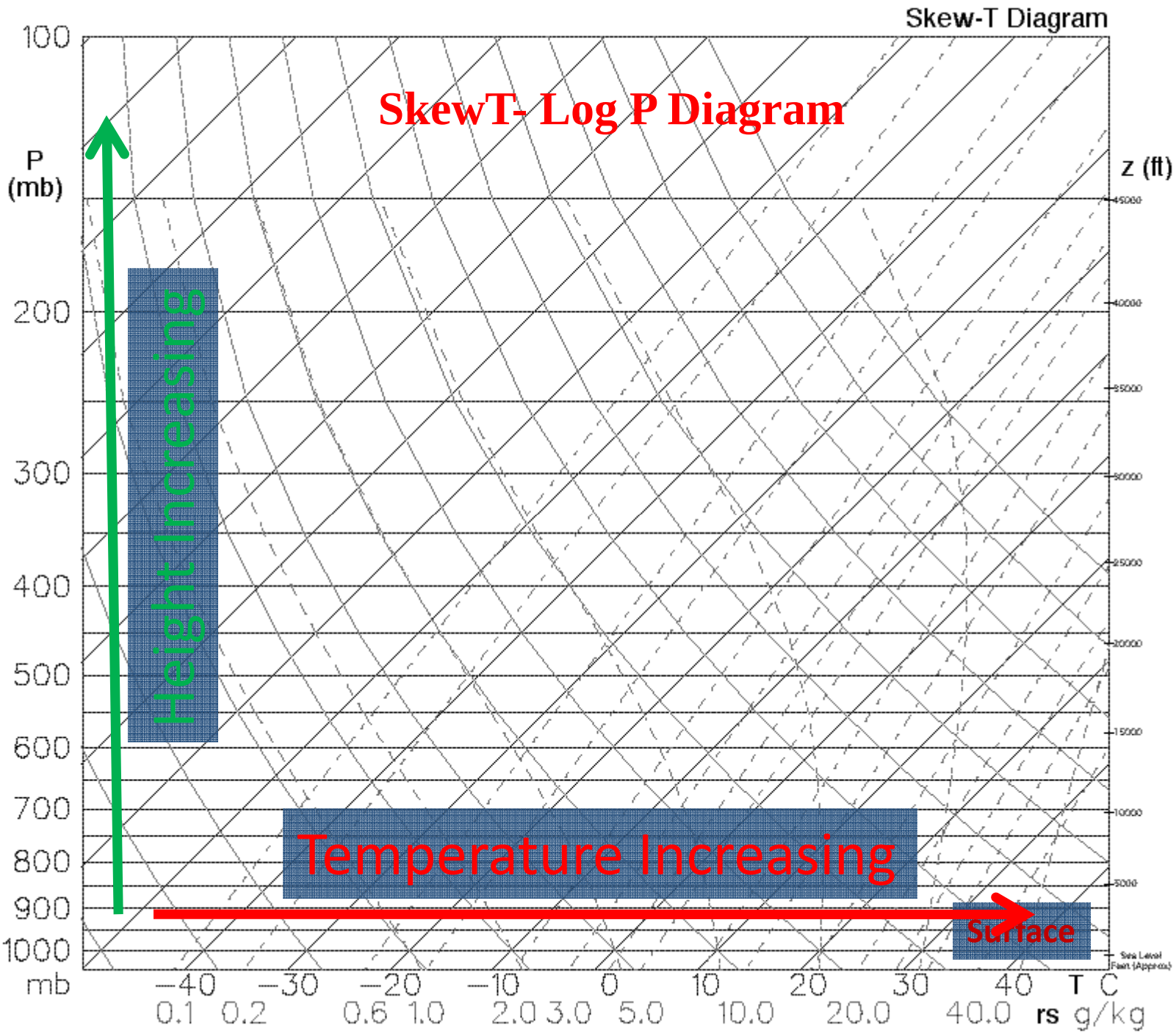
Caller #1: "I live in Quitman and there was quarter size hail falling downtown. A large oak tree also fell. There was very heavy rain for about 20 minutes, but I haven't seen any flooding in town."

Caller #2: "I tell you what. If you don't have a warning out, you are crazy. That storm was terrible. The rain was just pounding on my window and it didn't stop lightning for like five minutes."

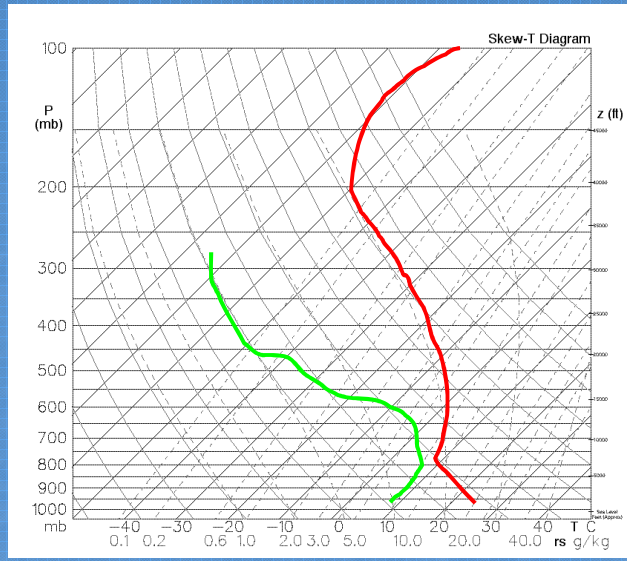
One of these reports is better than the other. Why?

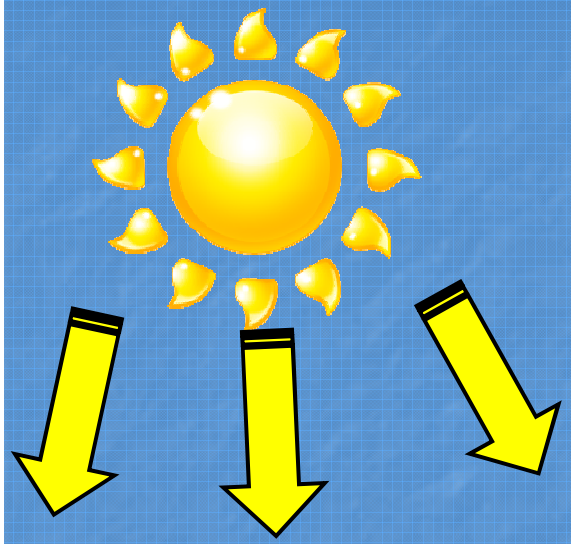
Convection

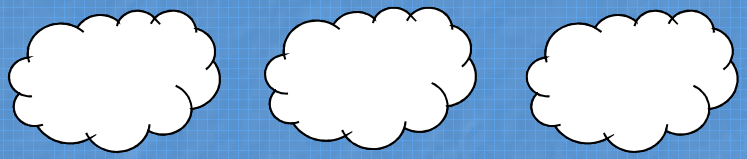
- As the sun heats the Earth, warmer air will rise.
- This rising "parcel" of air will continue to move upward, if the surrounding airmass is cooler than the air parcel.
- If the air parcel encounters warmer air, it will cease moving upward.


Skew-T Diagram
SkewT- Log P Diagram
P
(mb)
z (ft)
100
200
300
400
500
600
700
800
900
1000
mb
Height Increasing
Temperature Increasing
Surface
−40 −30 −20 −10 0 10 20 30 40 T C
0.1 0.2 0.6 1.0 2.0 3.0 5.0 10.0 20.0 40.0 rs g/kg

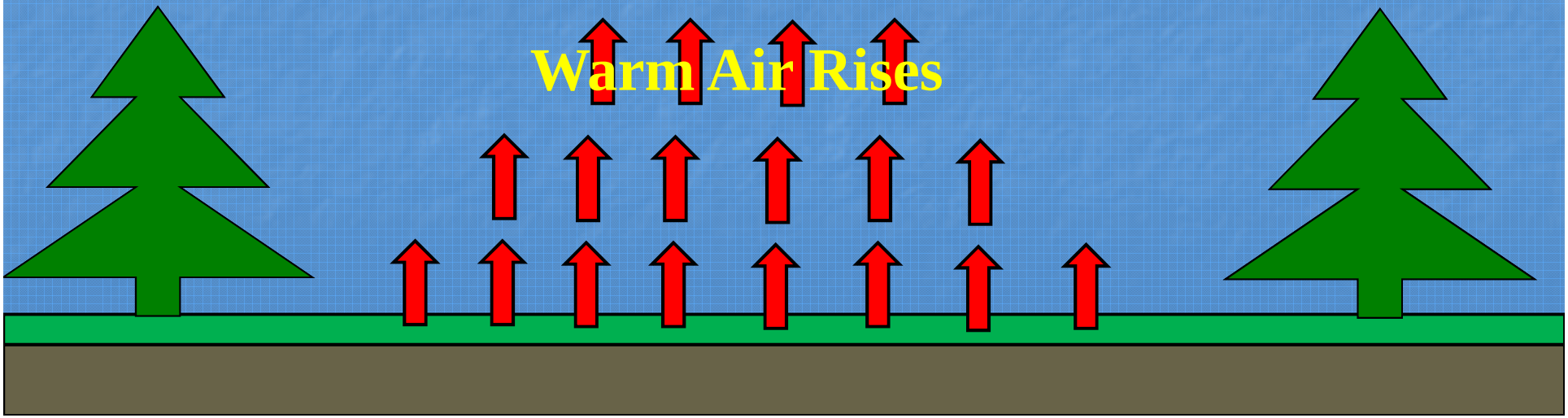
Convection



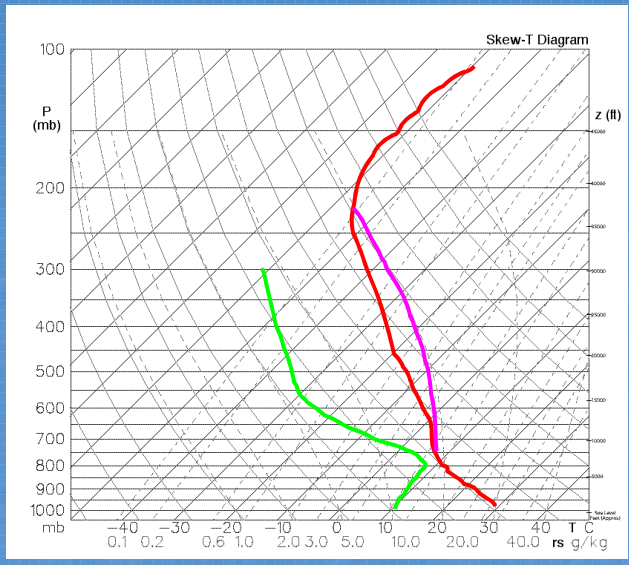


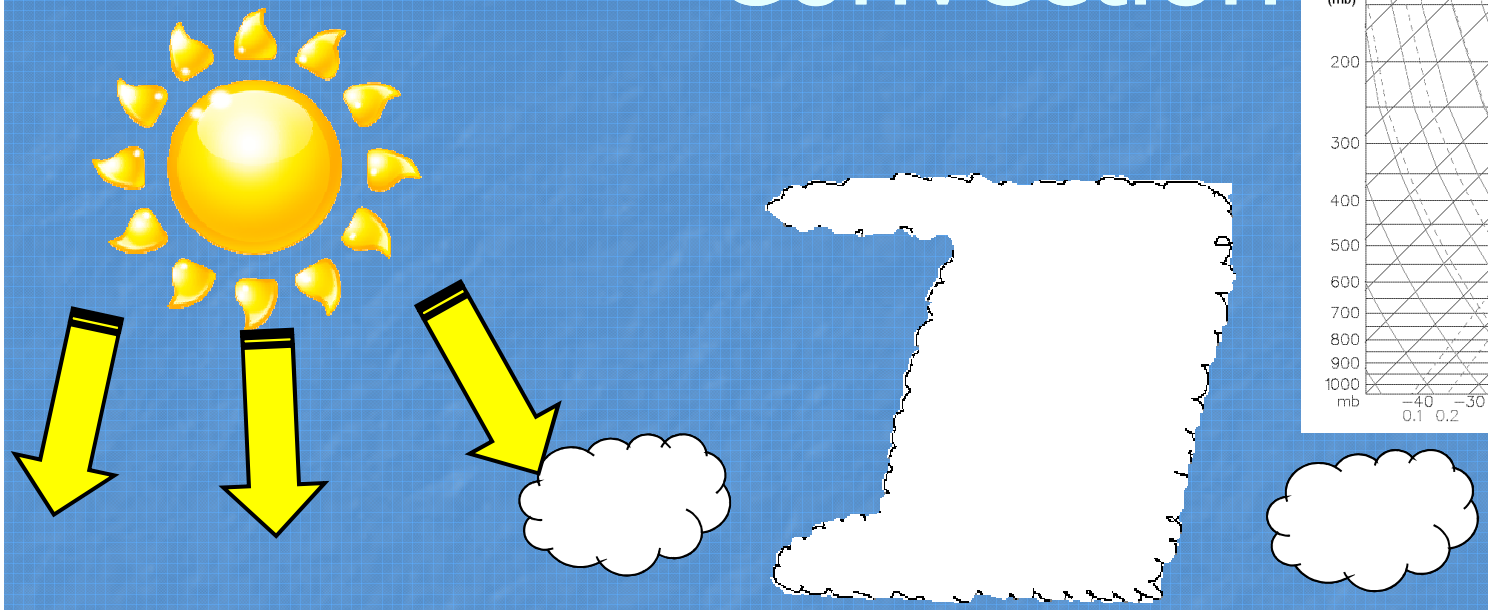


Rising air cools and condenses to form clouds

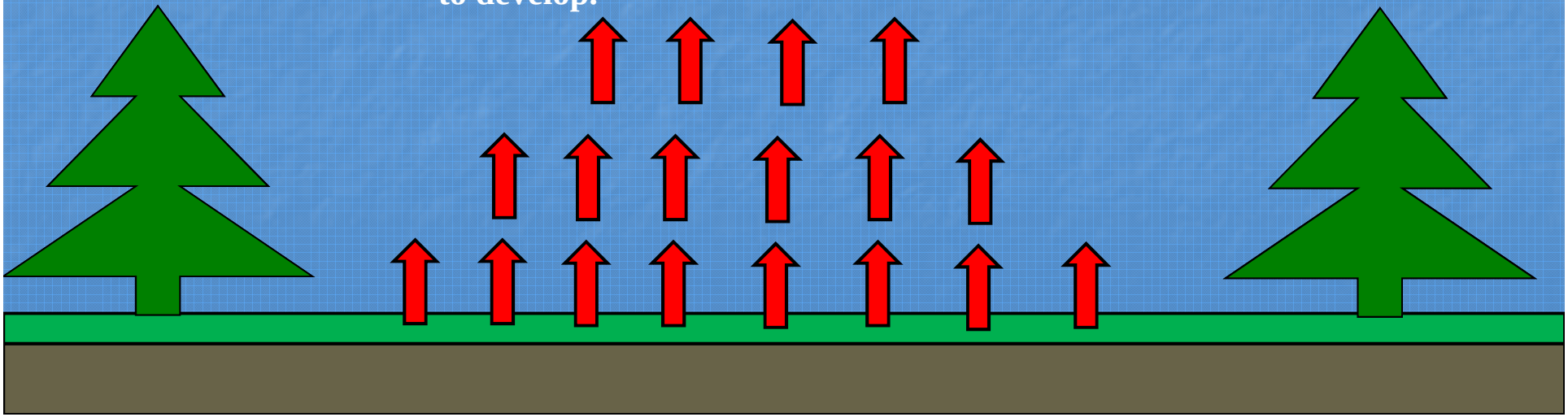


Convection

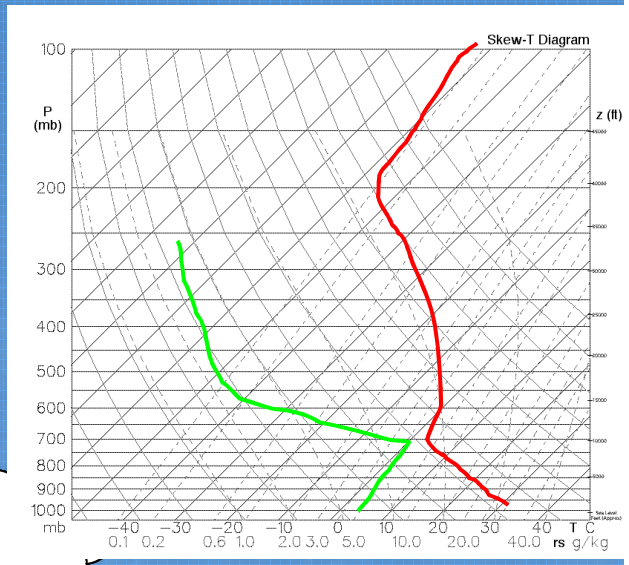


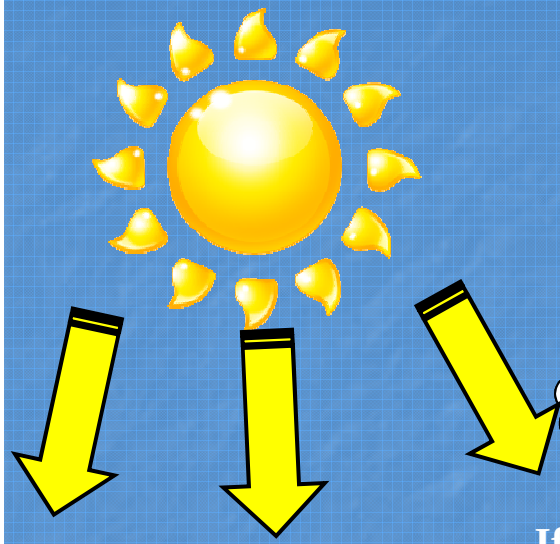


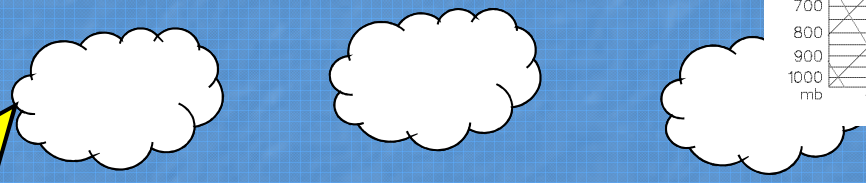
Over time, if the airmass remains unstable and moist enough, a thunderstorm will begin to develop.



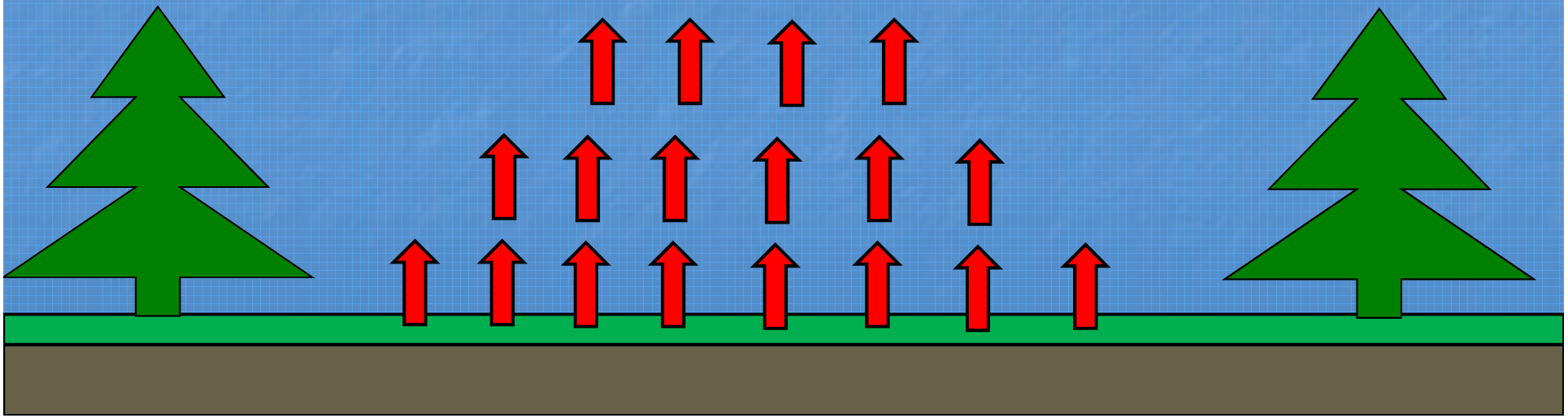
Convection





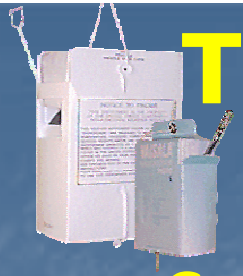


If the airmass is either not unstable or not moist enough, thunderstorms will not form, but cumulus clouds may persist.

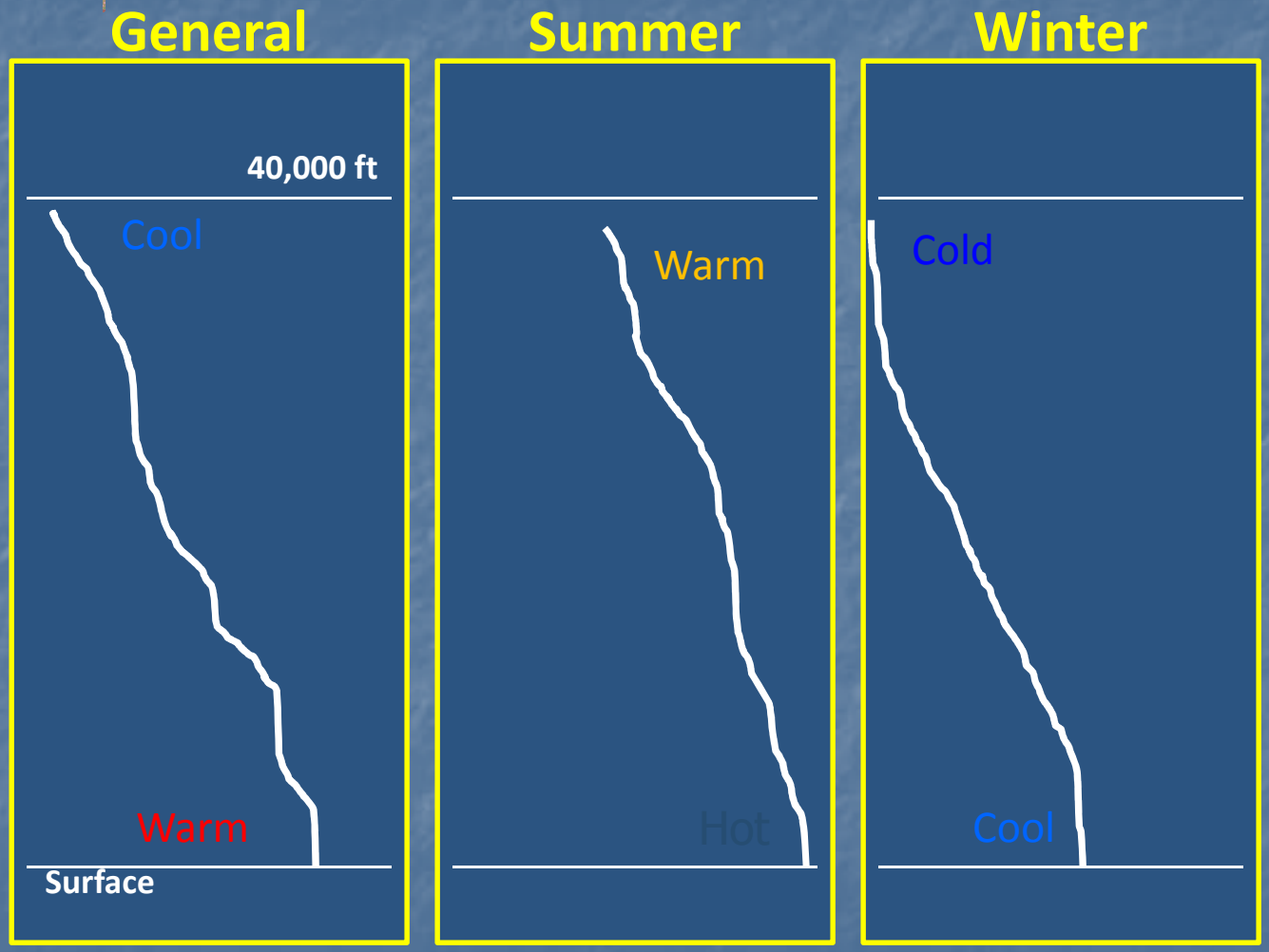


Severe Weather Forecasting

- For a significant severe weather event we need four main ingredients to come together
  - Instability (lots of warm air at the surface)
  - Moisture (southerly winds off the Gulf)
  - Lifting mechanism (strong cold front)
  - Wind shear (winds increasing and changing direction)
- Only on rare occasions do all four of these ingredients mix together at the same time in our region.

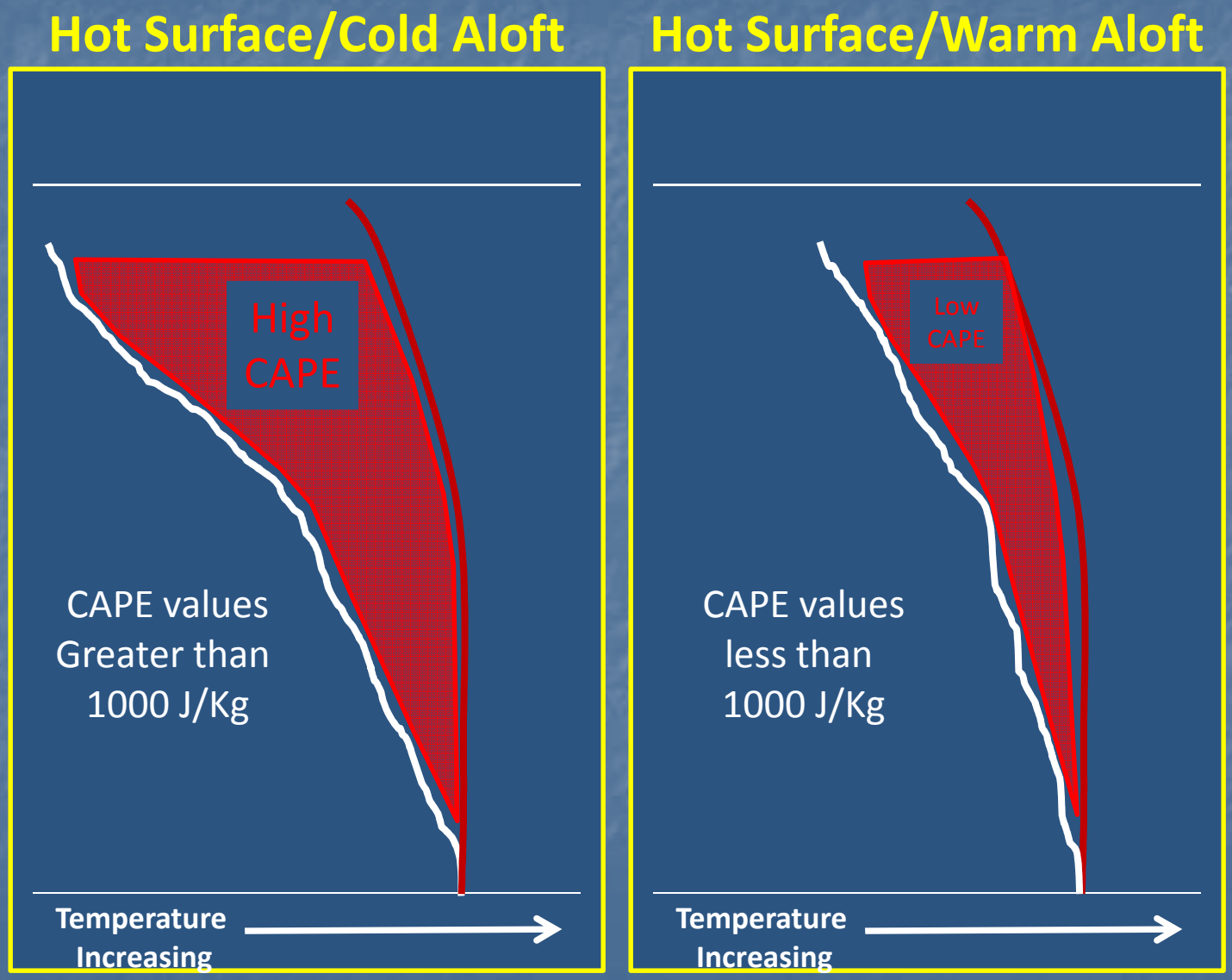


The 3-Dimensional Atmosphere: Instability



- In basic terms, the instability of the atmosphere is measured based upon how warm it is at the surface versus how cold it is aloft.
- In general, the atmosphere gets colder as you go up.
- During the summer, it is a lot hotter at the surface, but it is also warm aloft
- In the winter it is colder at the surface, but it is also colder in the upper atmosphere, as well.
- How is the instability calculated?

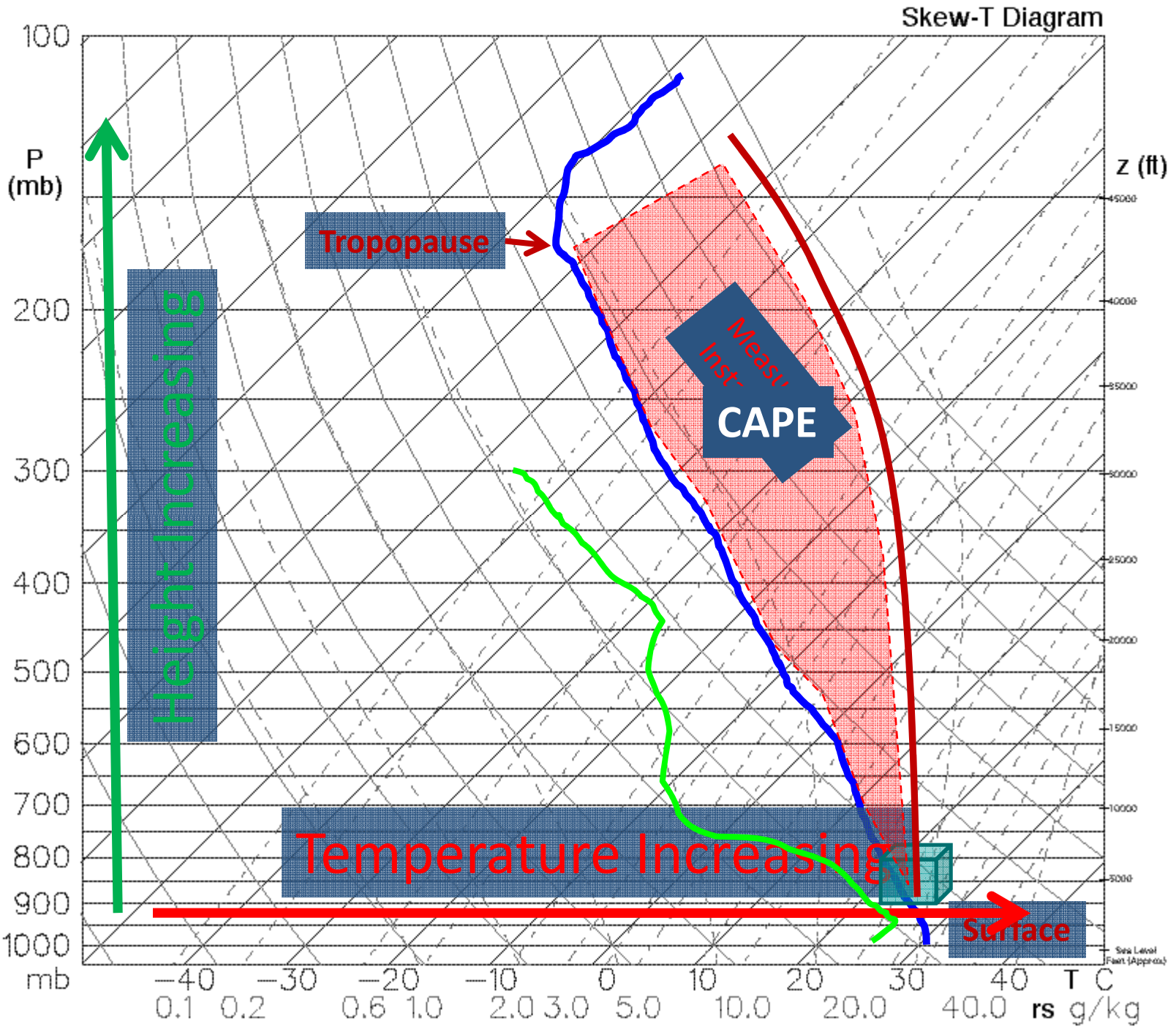
The 3-Dimensional Atmosphere Instability

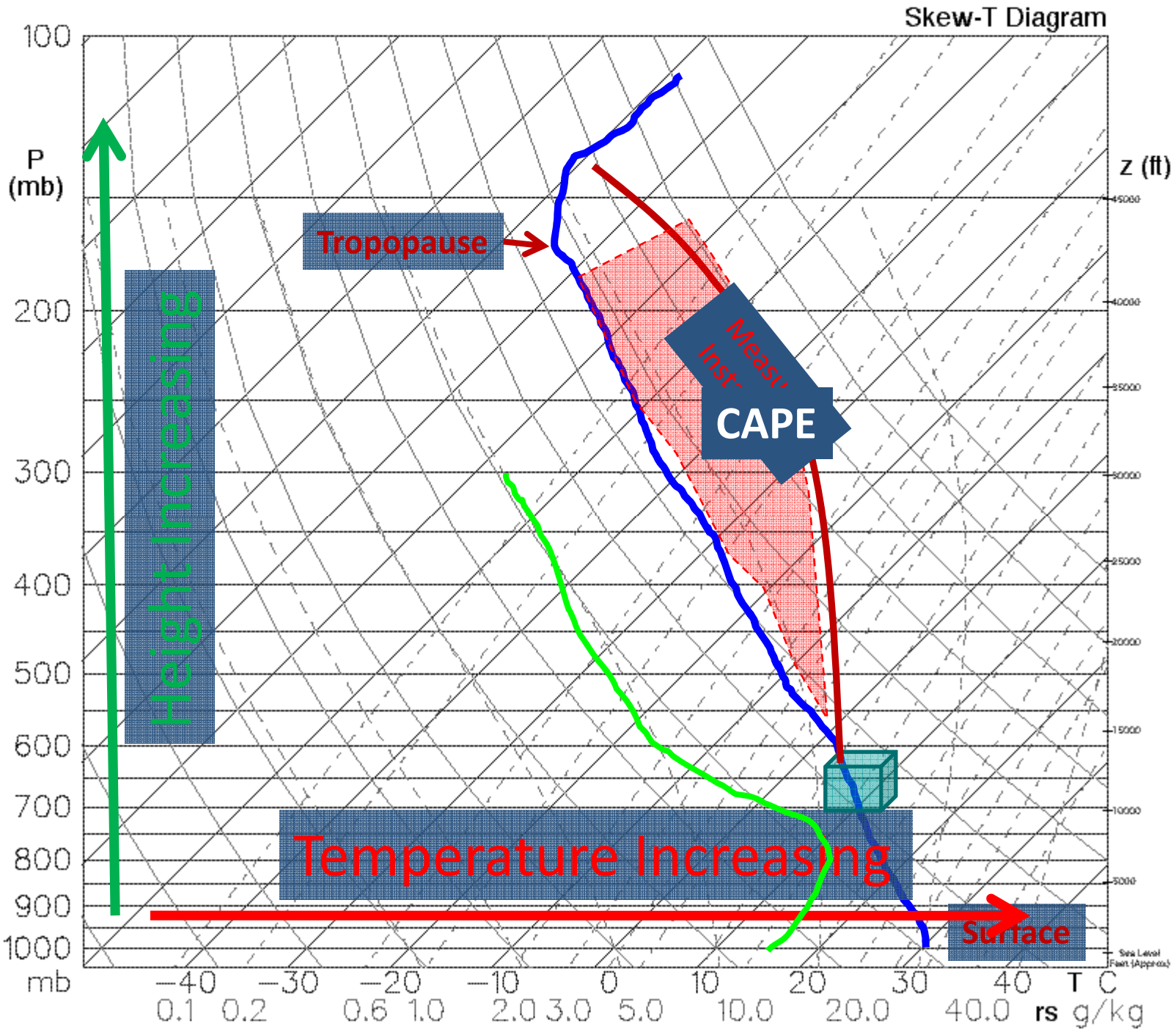


- CAPE stands for the Convective Available Potential Energy
- Depending on what type of CAPE exists (tall, short, skinny, fat) will determine the type and amount of thunderstorms that are possible (potential).

The 3-Dimensional Atmosphere Instability

- CAPE is most often referenced relative to the surface layer
- Surface temperature and dewpoint influence the initial calculations of CAPE
- Dewpoint (higher or lower) will lead to higher CAPE values, if the upper level atmosphere remains unchanged.


Skew-T Diagram
P (mb)
z (ft)
100
200
300
400
500
600
700
800
900
1000
mb
Tropopause
Height Increasing
Meas' Inst'
CAPE
Temperature Increasing
Surface
−40 −30 −20 −10 0 10 20 30 40 T C
0.1 0.2 0.6 1.0 2.0 3.0 5.0 10.0 20.0 40.0 rs g/kg

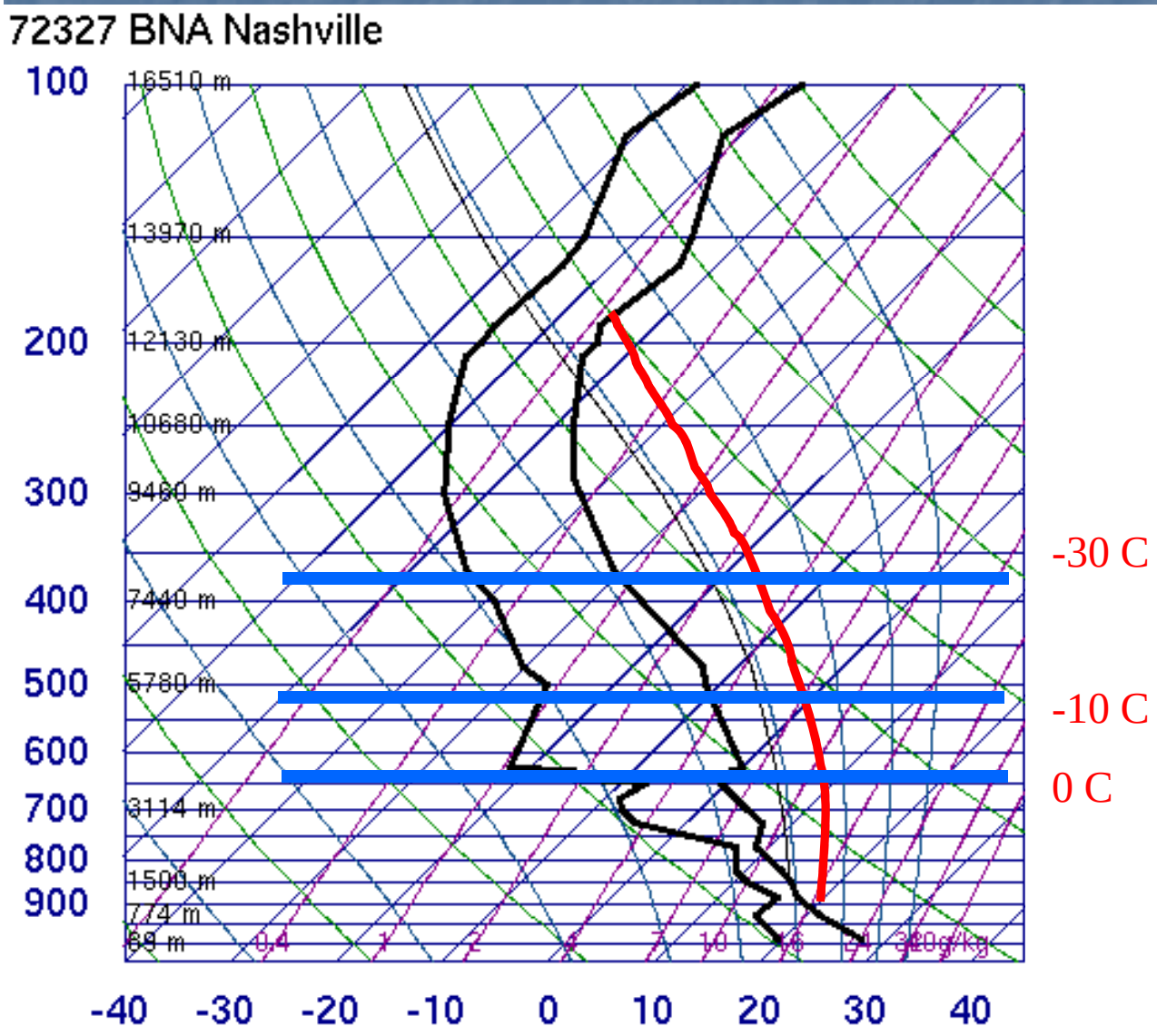

Skew-T Diagram
P (mb)
z (ft)
100
200
300
400
500
600
700
800
900
1000
mb
Tropopause
Height Increasing
Meas' Inst'
CAPE
Temperature Increasing
Surface
−40 −30 −20 −10 0 10 20 30 40 T C
0.1 0.2 0.6 1.0 2.0 3.0 5.0 10.0 20.0 40.0 rs g/kg

Diagnosing Hail Potential

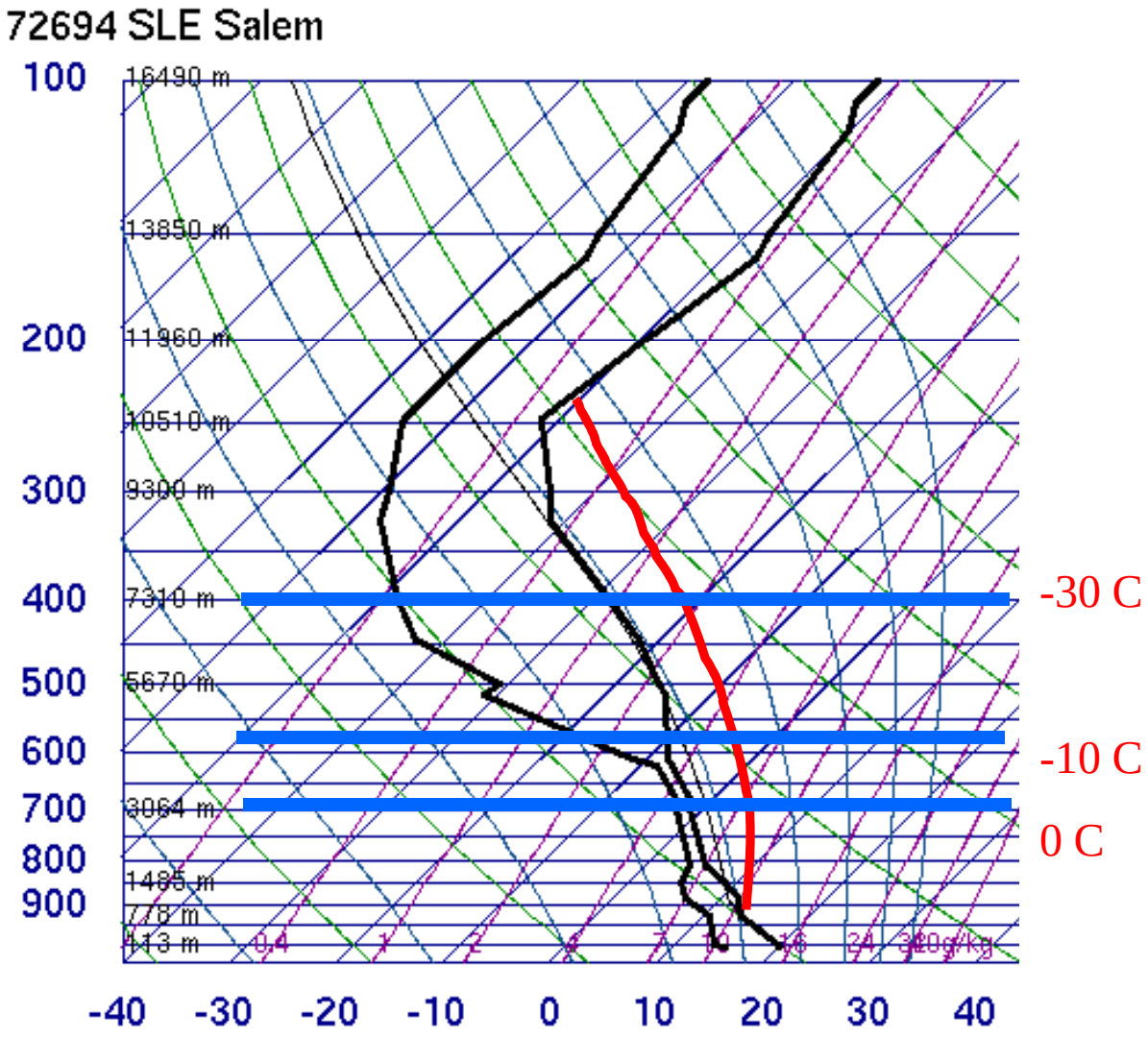
- Hail develops when a strong updraft lifts raindrops higher into a thunderstorm, resulting in freezing.
- Because updraft speed is roughly correlated to CAPE, higher values of CAPE can approximate hail potential.

$$\sqrt{2 * CAPE} = \text{Maximum Updraft Speed (m/s)}$$

Diagnosing Hail Potential



Diagnosing Hail Potential



Wind Shear and its role

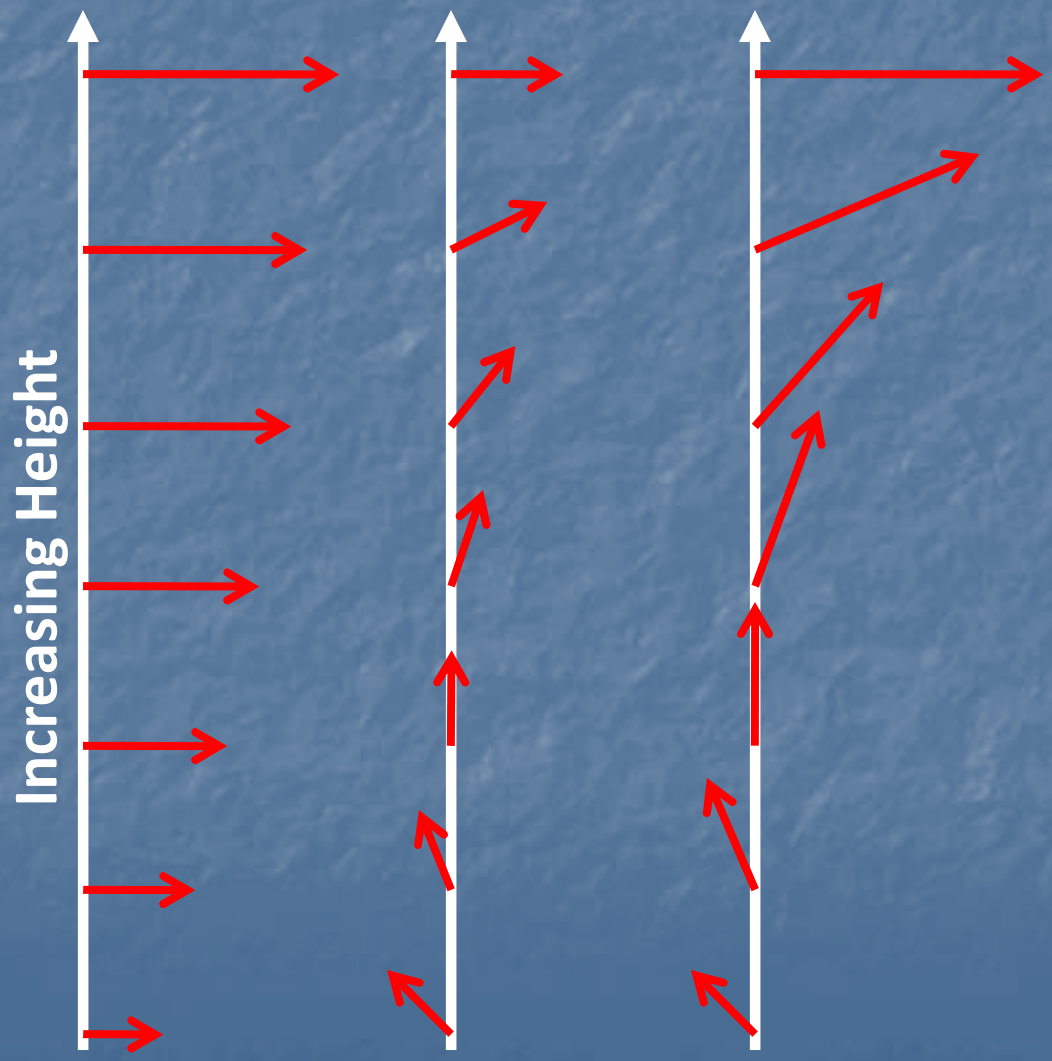
- Wind shear is the measurement of the difference in either wind speed or wind direction with height.
- Wind shear has a direct relationship with storm type and severe potential.
- Storm Relative Helicity (SRH) indicates the potential of severe storms to contain rotating updrafts.

Storm Type	0-1 km shear	0-6 km shear	0-1 km SRH
Ordinary Cell	N/A	5 kt	N/A
Multicell	10 kt	20 kt	$<25\ m^2/s^2$
Weak supercell	20 kt	35-40 kt	$<50\ m^2/s^2$
Supercell	30 kt	50-60 kt	$>100\ m^2/s^2$

Wind Shear - Continued

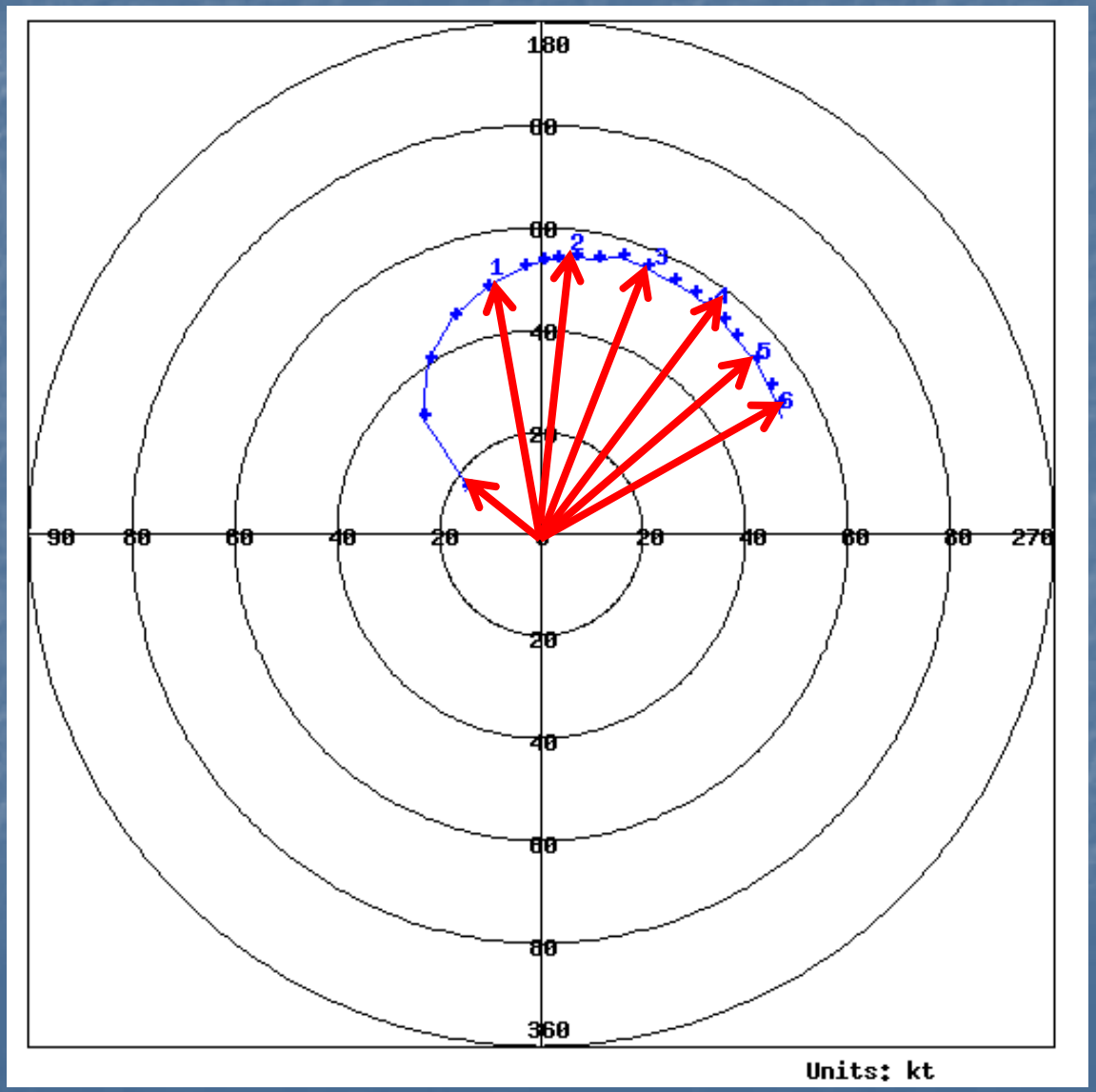
- Wind shear direction is also important for determining storm behavior
- Adding curvature to the flow may lead to the development of dominant "right moving" supercells
- Flow that is nearly unidirectional will tend to favor splitting cells. "Left moving" cells in this flow will tend to be large hail producing storms.

The 3-Dimensional Atmosphere
Wind Shear



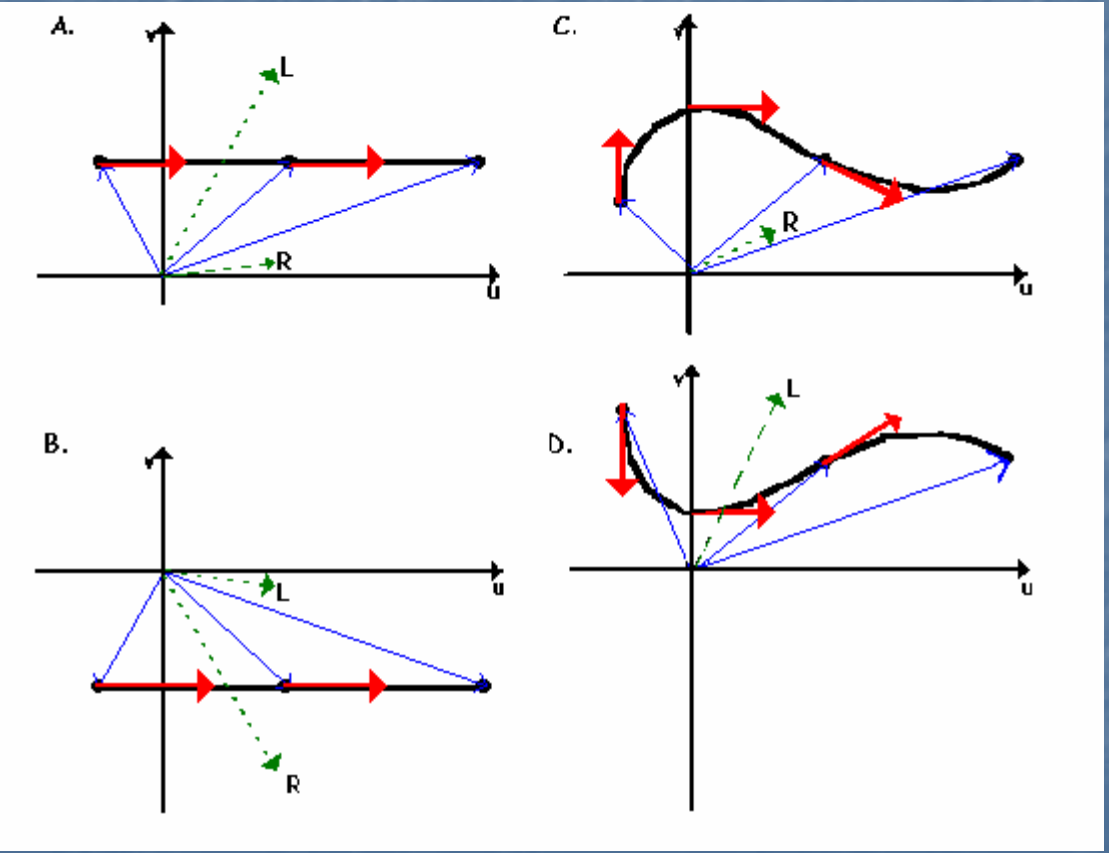
- Wind shear can be calculated in three ways
- Change in wind speed with height
- Change in wind direction with height
- Change in both speed and direction with height

The 3-Dimensional Atmosphere Wind Shear



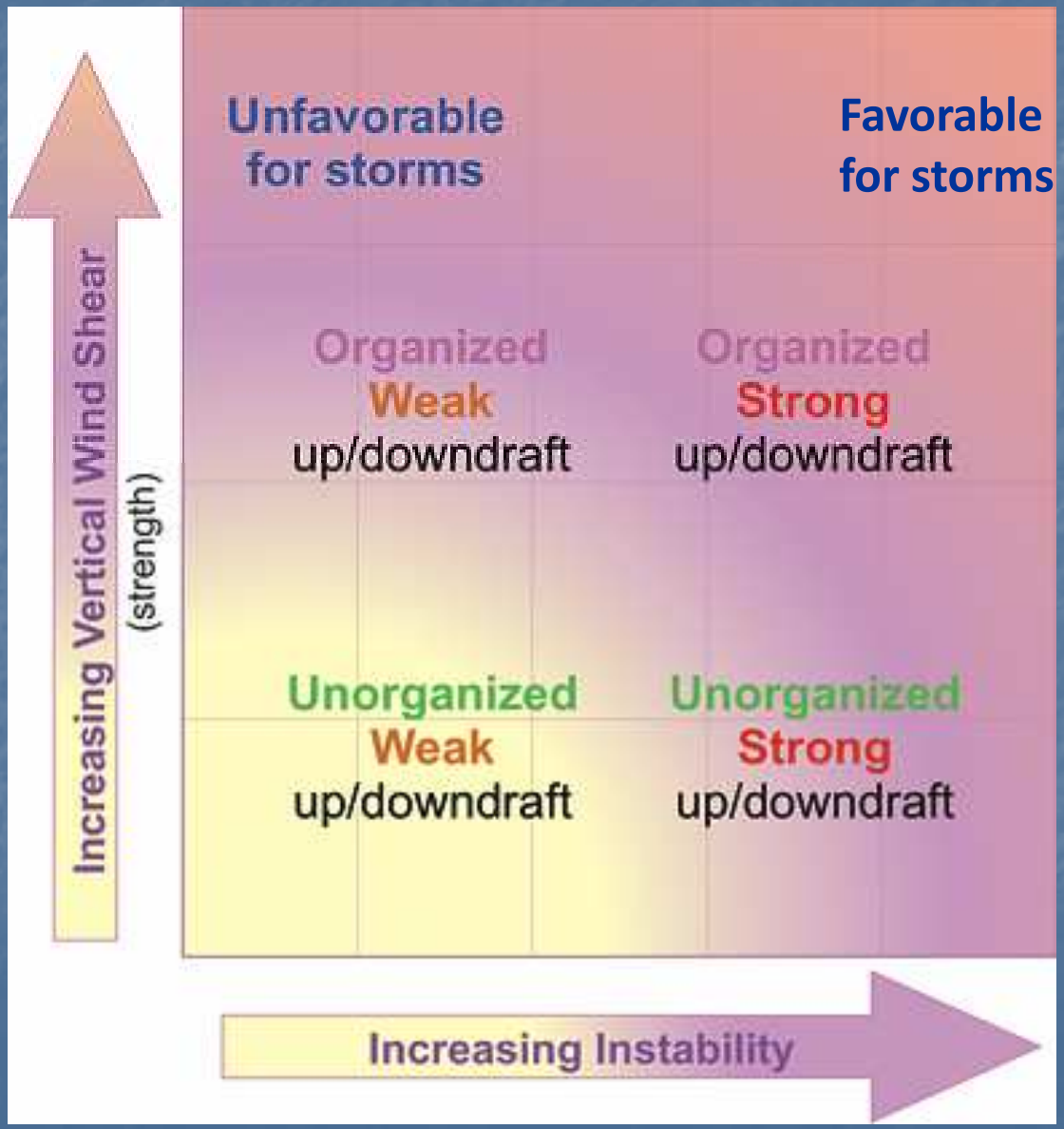
- Wind speed is typically calculated in terms of speed and direction change in the term Helicity or Storm Relative Helicity.
- Helicity is measured at several height levels, and that determines what type of storm is likely to form or what the mode of convection will be.
- 0 to 6 kilometers (storm motions)
- 0 to 3 km (supercells, multicell, or ordinary cell?)
- 0 to 1 km (tornadoes?)

Various Shear Scenarios



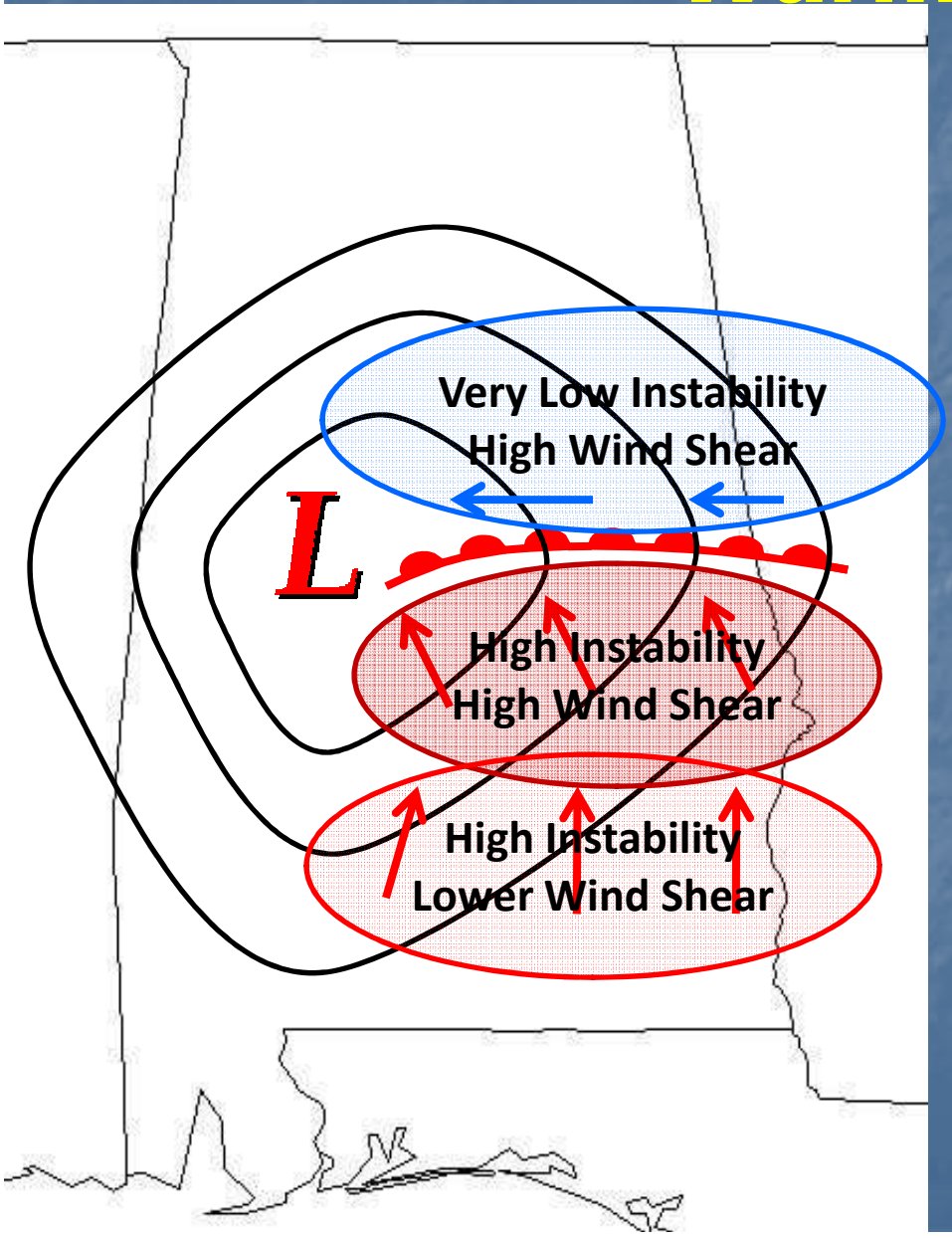
- Straight shear scenarios (A & B) depict splitting cells and their direction of motion.
- Curved shear scenarios (C & D) depict right moving or left moving dominant supercells.

Finding the Perfect Balance Instability versus Wind Shear



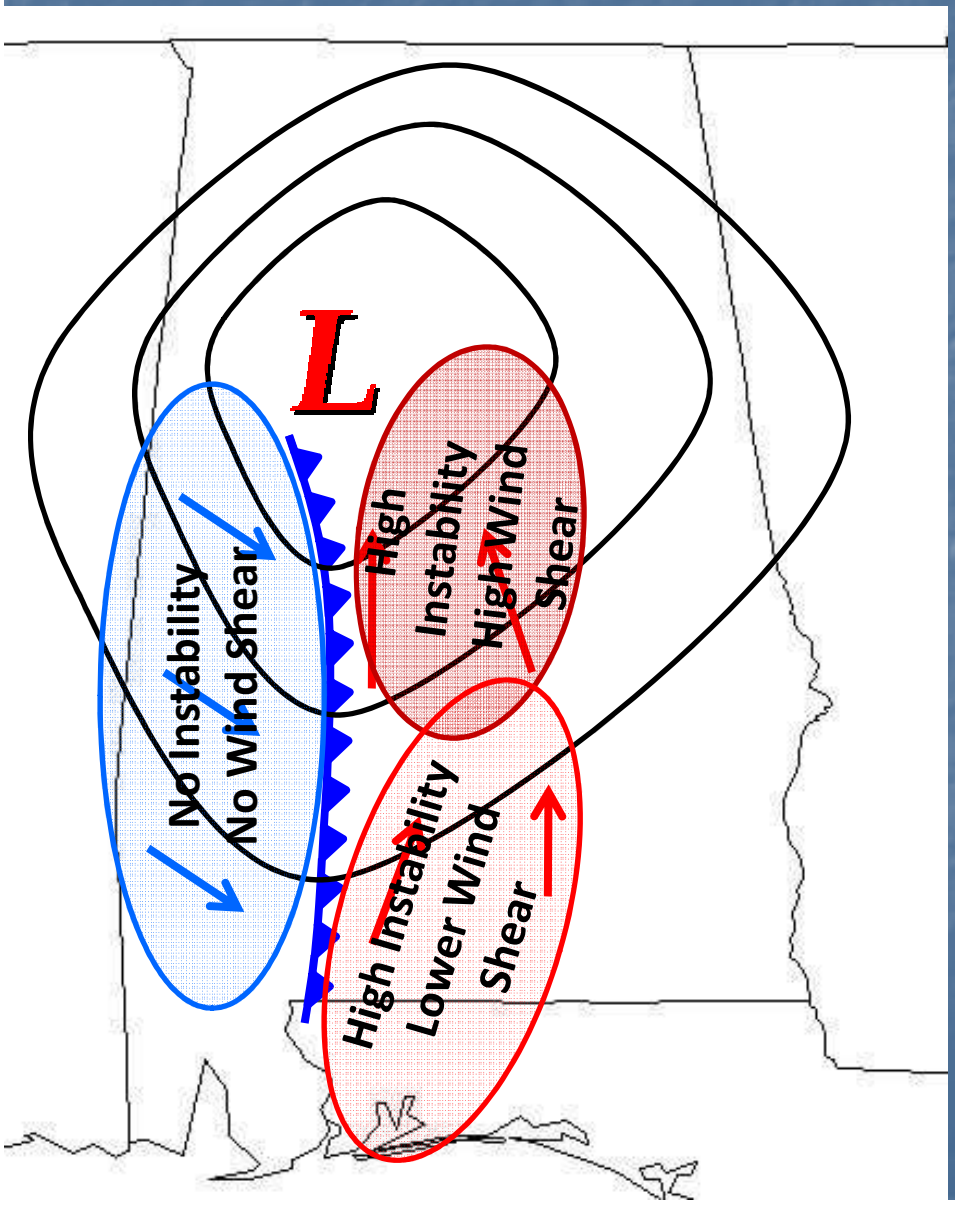
- Finding the perfect balance between instability and wind shear remains a forecast challenge.
- All about the favorable mode of convection.

The 3-Dimensional Atmosphere
Warm Front



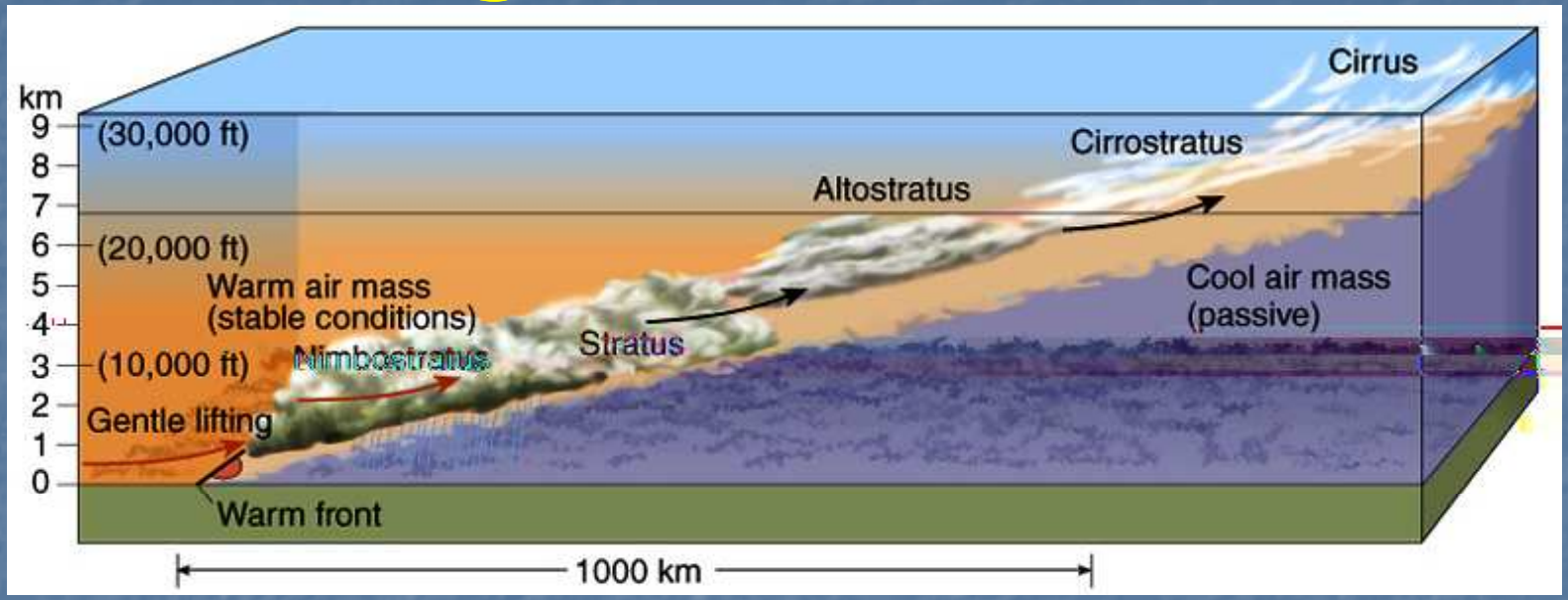
- Warm fronts are typically characterized by a distinct wind-shift from the south to the east as you go from south to north.
- South of the warm front the airmass is unstable with high wind shear.
- North of the warm front the wind shear can remain high, but the instability decreases significantly.

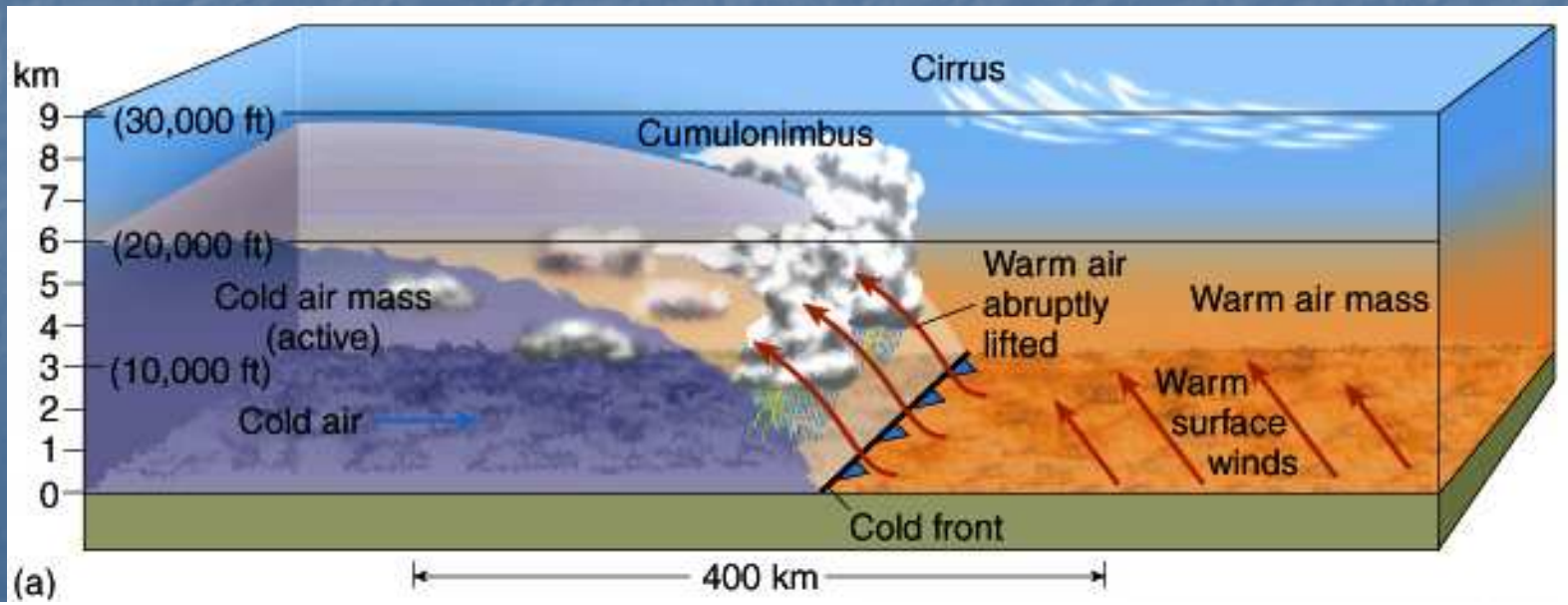
The 3-Dimensional Atmosphere
Cold Front

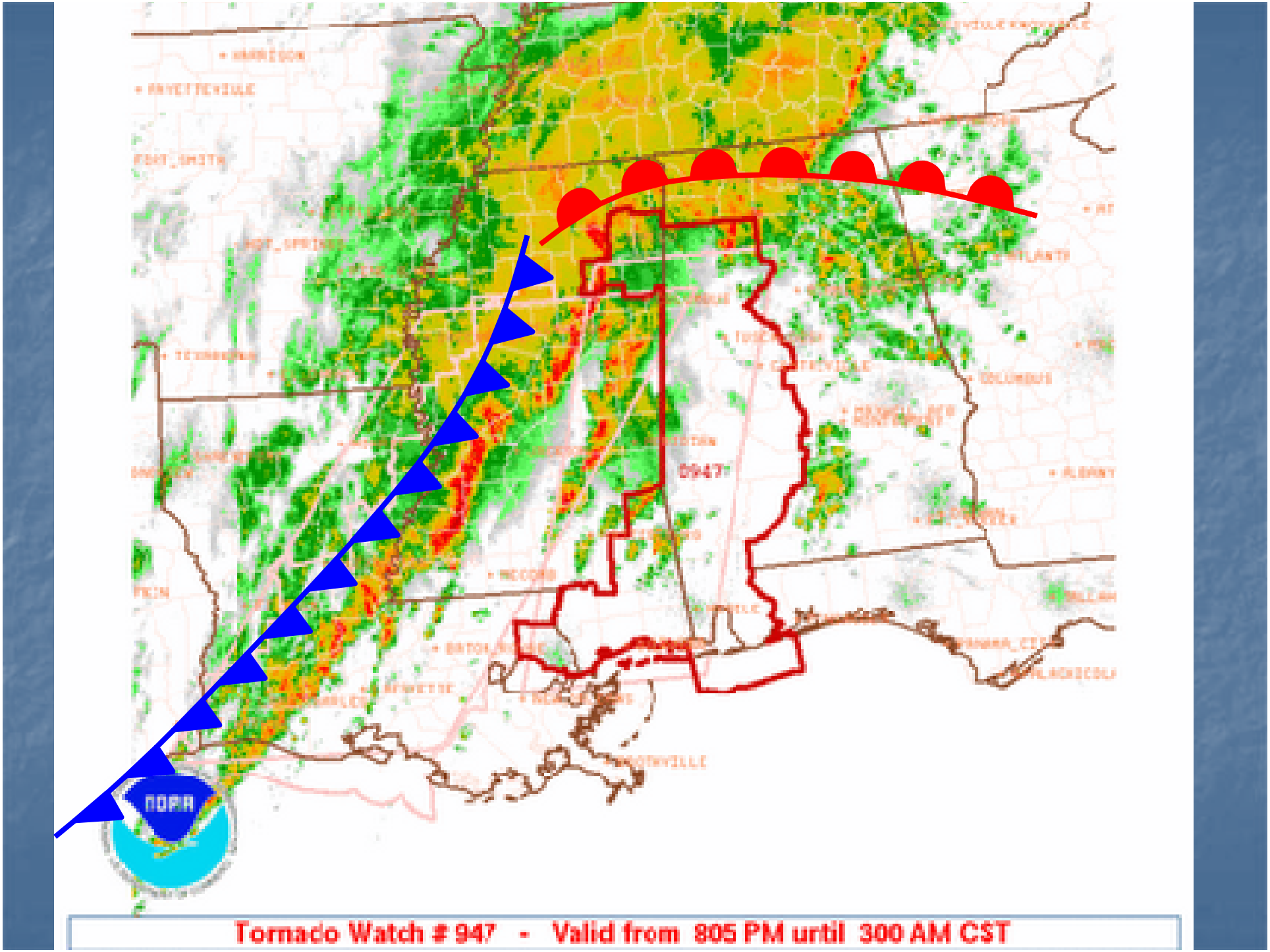


- Cold Fronts are characterized by an abrupt wind-shift from the south to the northwest as you go from west to east.
- Ahead of the cold front, generally there is unstable air with high wind shear.
- Behind the cold front the air is colder, drier and virtually no instability or

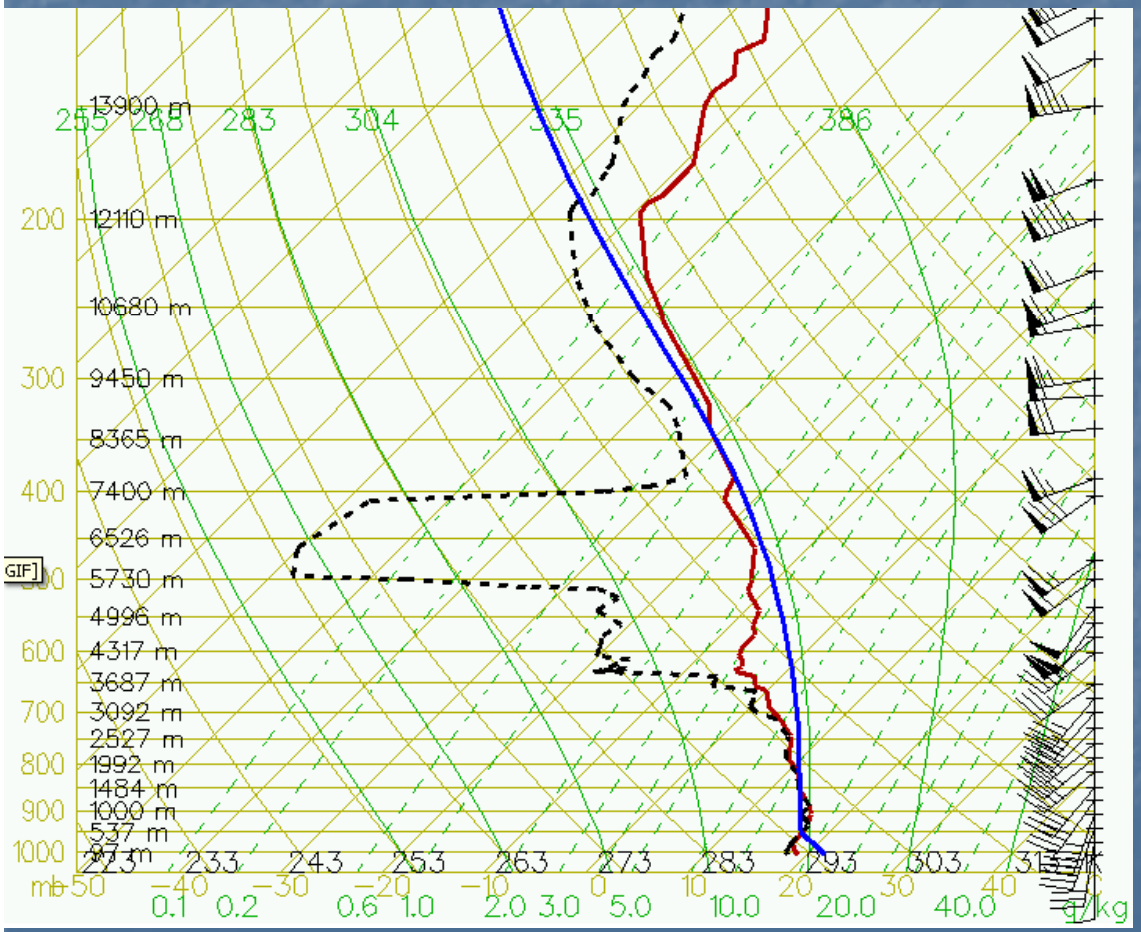
The 3-Dimensional Atmosphere Lifting Mechanism





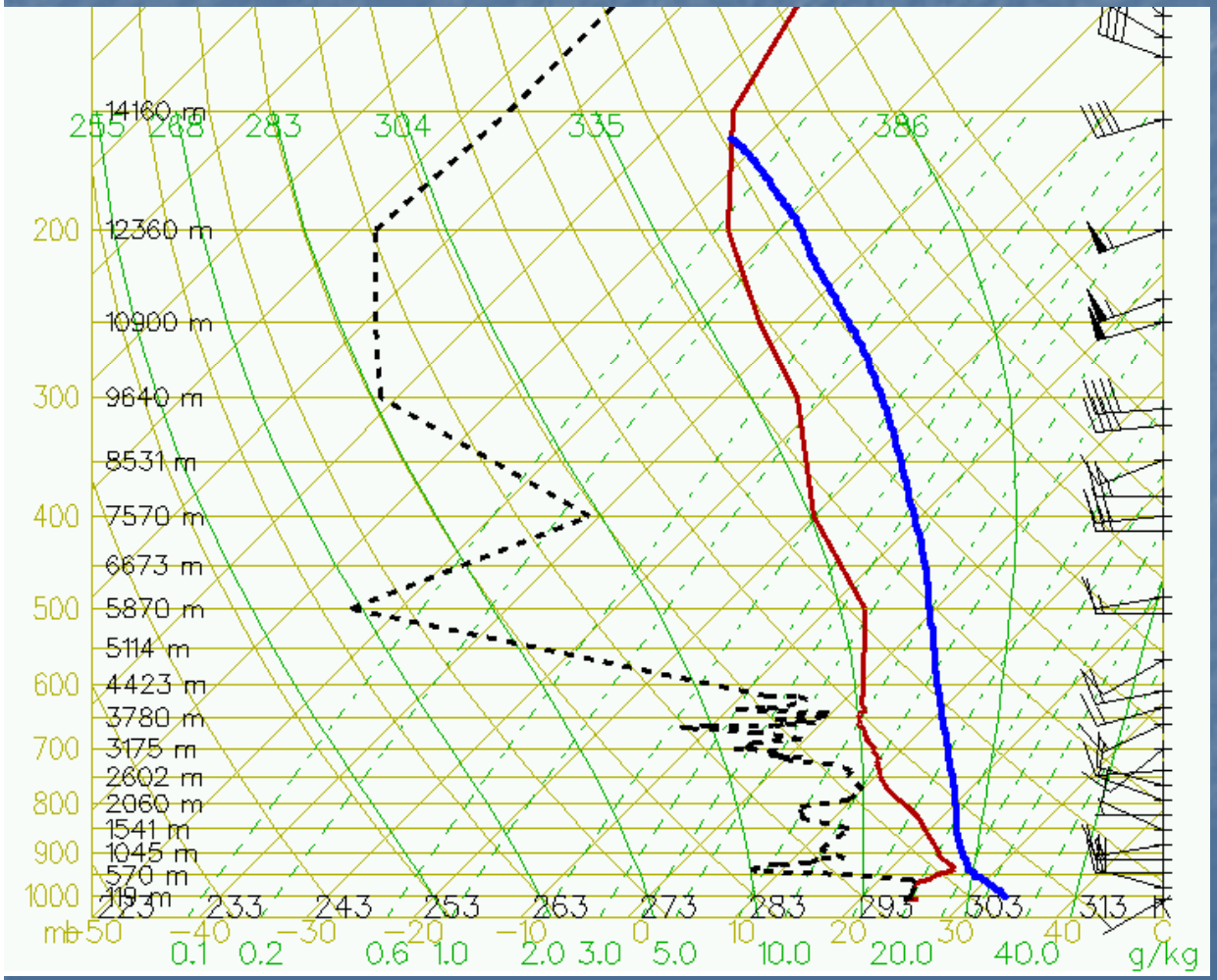

Tornado Watch # 947 - Valid from 805 PM until 300 AM CST

Cool Season Severe Storms



- Low CAPE, High Shear environments
- Often depend on quality and extent of warm moist airmass for severe potential
- General Guidelines:
  - CAPE > 250 J/KG
  - Return flow (SE-S-SW) for 24 hours over Gulf airmass with dewpoints >60.
  - Neutral or negatively tilted 500 mb trough
- There are always exceptions
  - Capitola, FL Tornado (EF-1)
  - CAPE : 2 J/KG, but SRH 800 m^2/s^2

Warm Season Storms

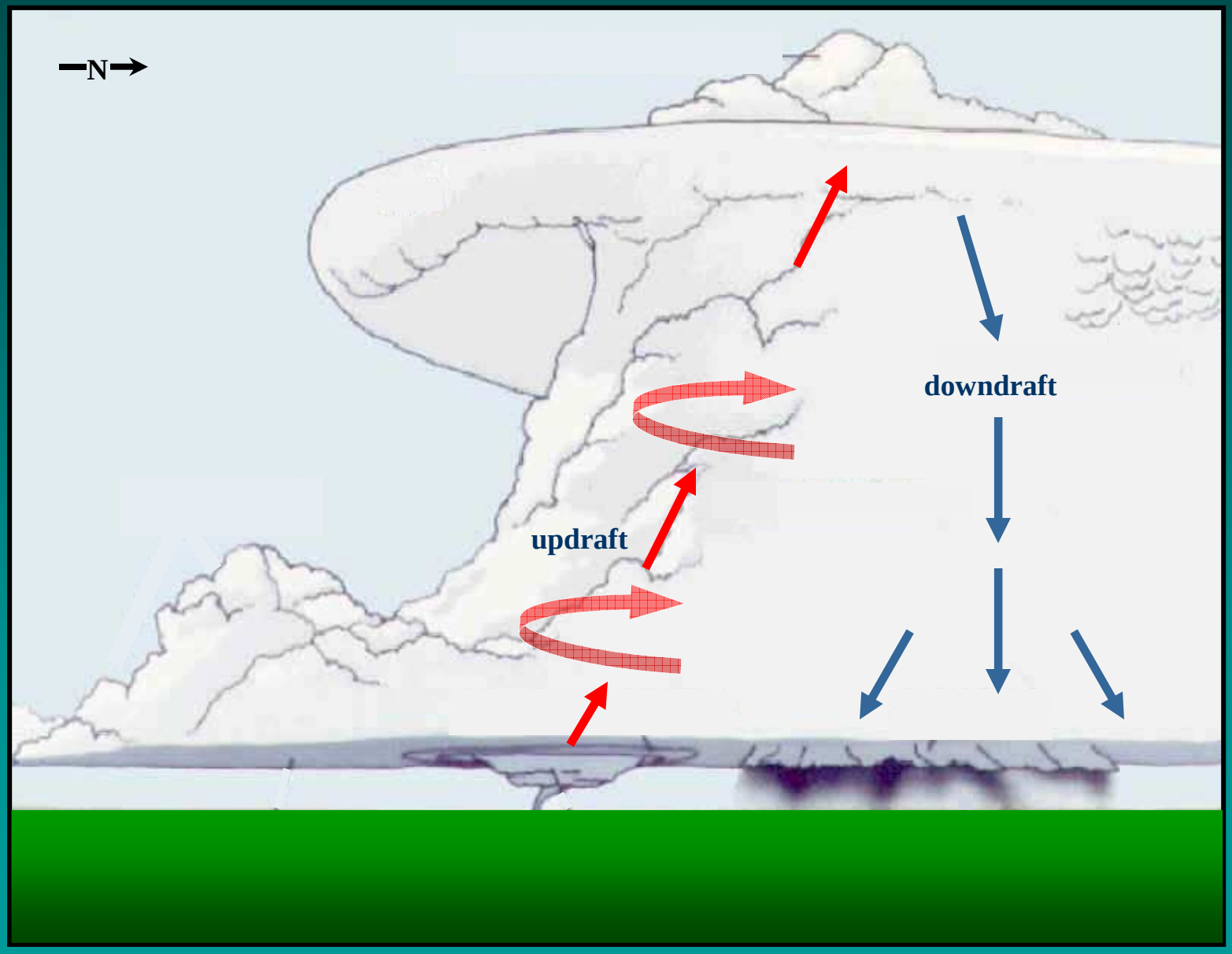


- Predominantly weak shear, high CAPE events.
- Sea breeze interactions drive severe potential
- Too much moisture or active sea breeze fronts can inhibit severe potential.
- Mid level dry air can actually enhance downburst potential.
- Things to look for:
  - 700-500 mb dewpoint depressions elevated
  - Convergent flow relative to sea breeze boundaries (West, Northwest, Northeast, East)
  - Freezing level less than 15,000 ft.
  - Severe hail is most likely in June or July.

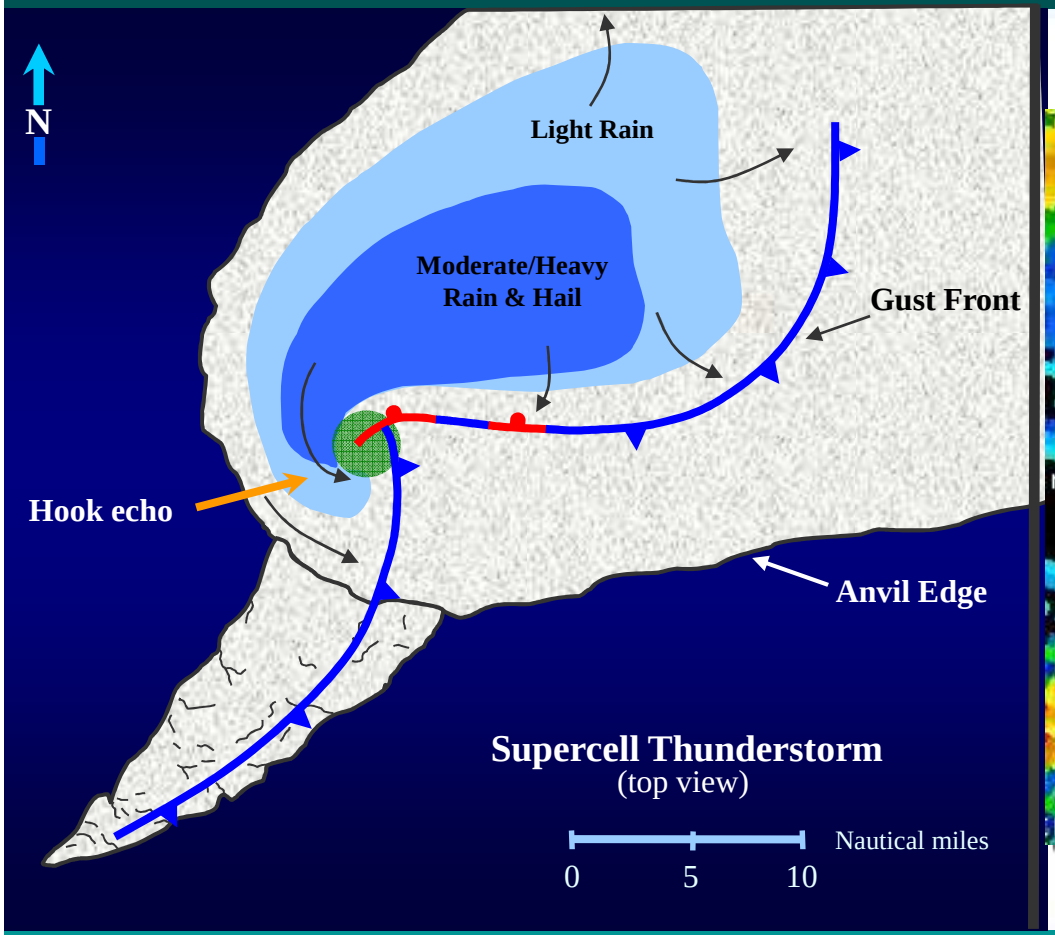
Common Thunderstorm Types

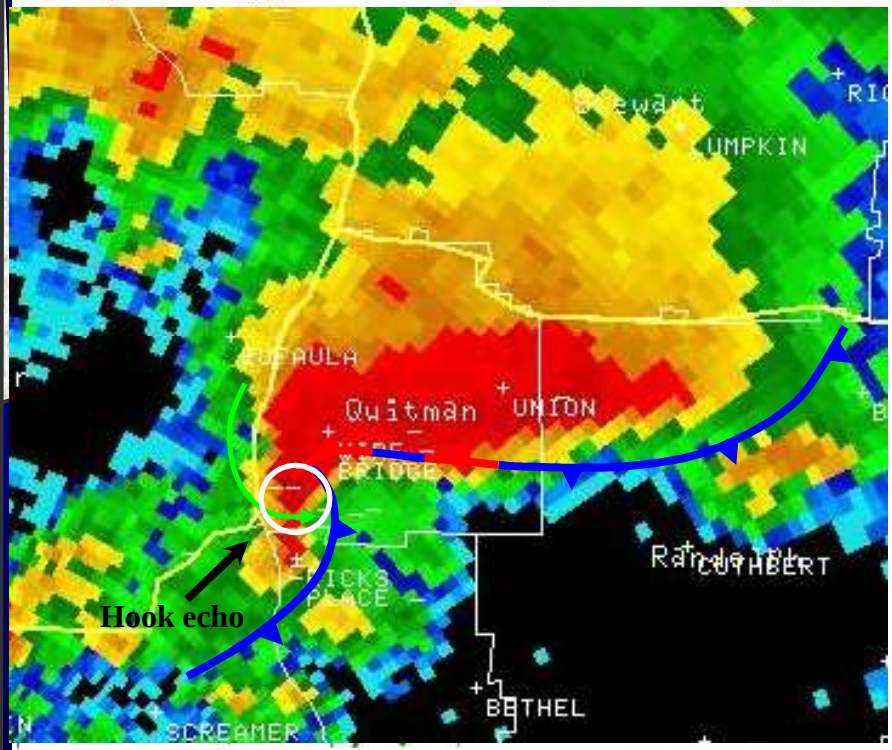
- ***Multicell* - ordinary storms with low severe threat**
- ***Squall line* - line of storms with moderate wind threat**
- ***Classic Supercell* - rotating updraft with high severe threat**
- ***HP (high precipitation) Supercell* - rotating updraft often times obscured by heavy rain, high severe threat**

Classic Supercell Thunderstorm

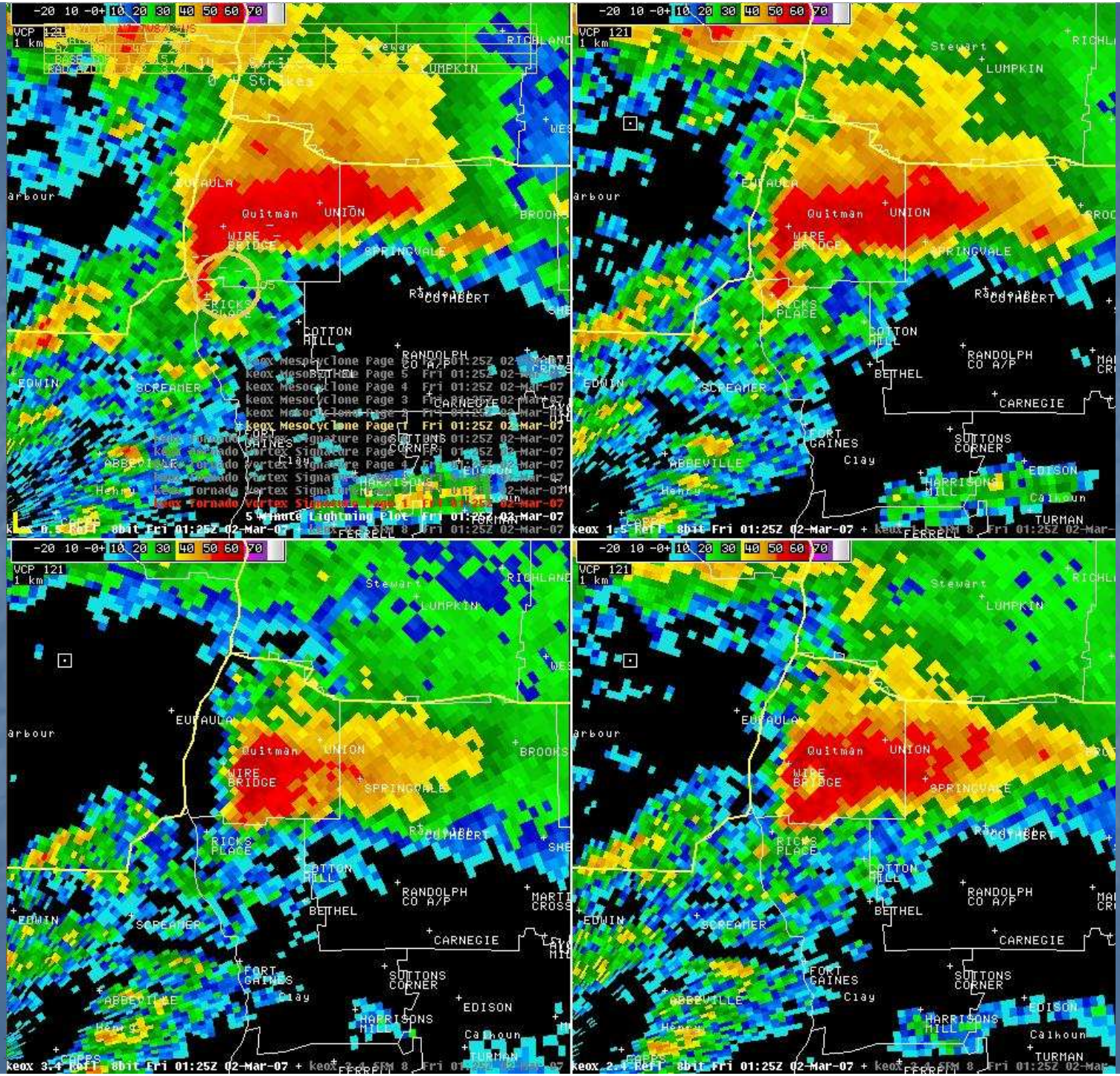


Classic Supercell Thunderstorm



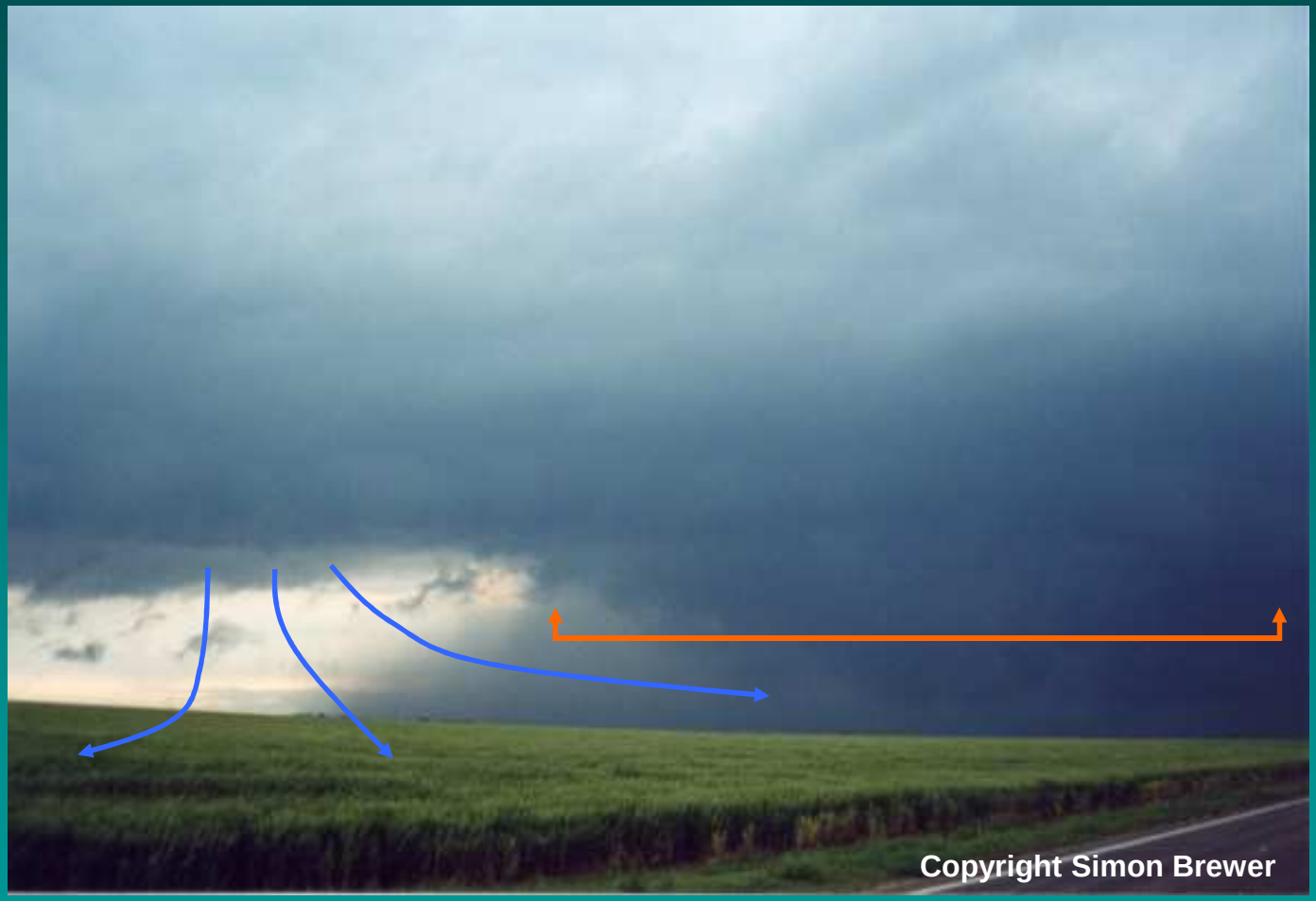


WSR-88D Radar Image

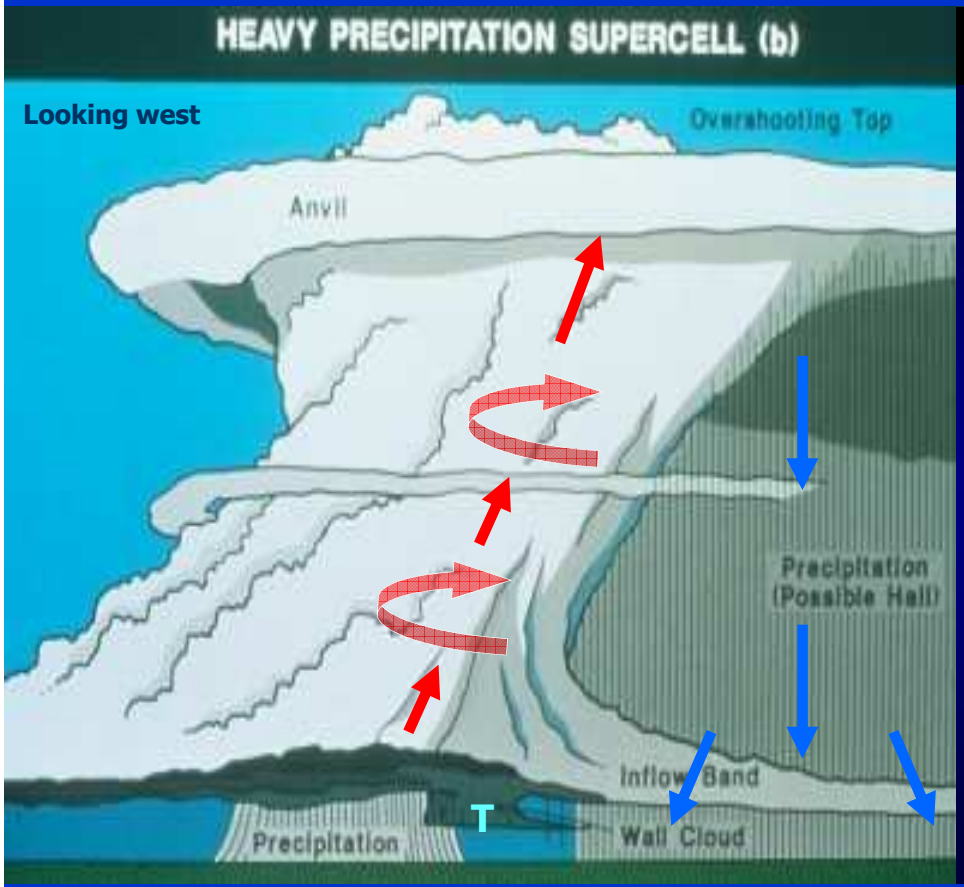

-20 10 -0+ 10 20 30 40 50 60 70
VCP 121
1 km
Stewart
LUMPKIN
RICHLAND
EUFAULA
Quitman
UNION
WIRE BRIDGE
SPRINGVALE
BROOKS
RICKS PLACE
COTTON HILL
RANDOLPH CO A/P
BETHEL
EDWIN
SCREAMER
CARNEGIE
FORT GAINES
SUTTONS CORNER
ABBEVILLE
Clay
HARRISONS MILL
EDISON
Calhoun
TURMAN
FERRELL
keox 1.5 Refl 8bit Fri 01:25Z 02-Mar-07
keox 3.4 Refl 8bit Fri 01:25Z 02-Mar-07
keox 2.4 Refl 8bit Fri 01:25Z 02-Mar-07

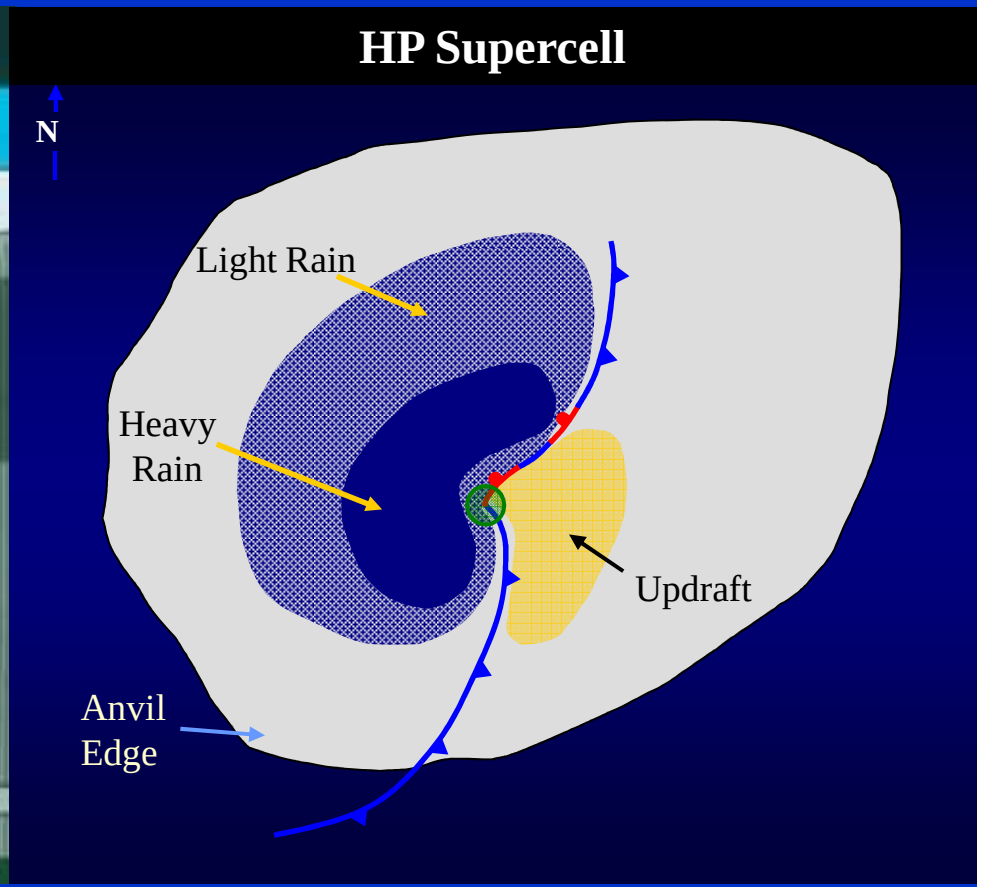

BMott

Rear Flank Downdraft

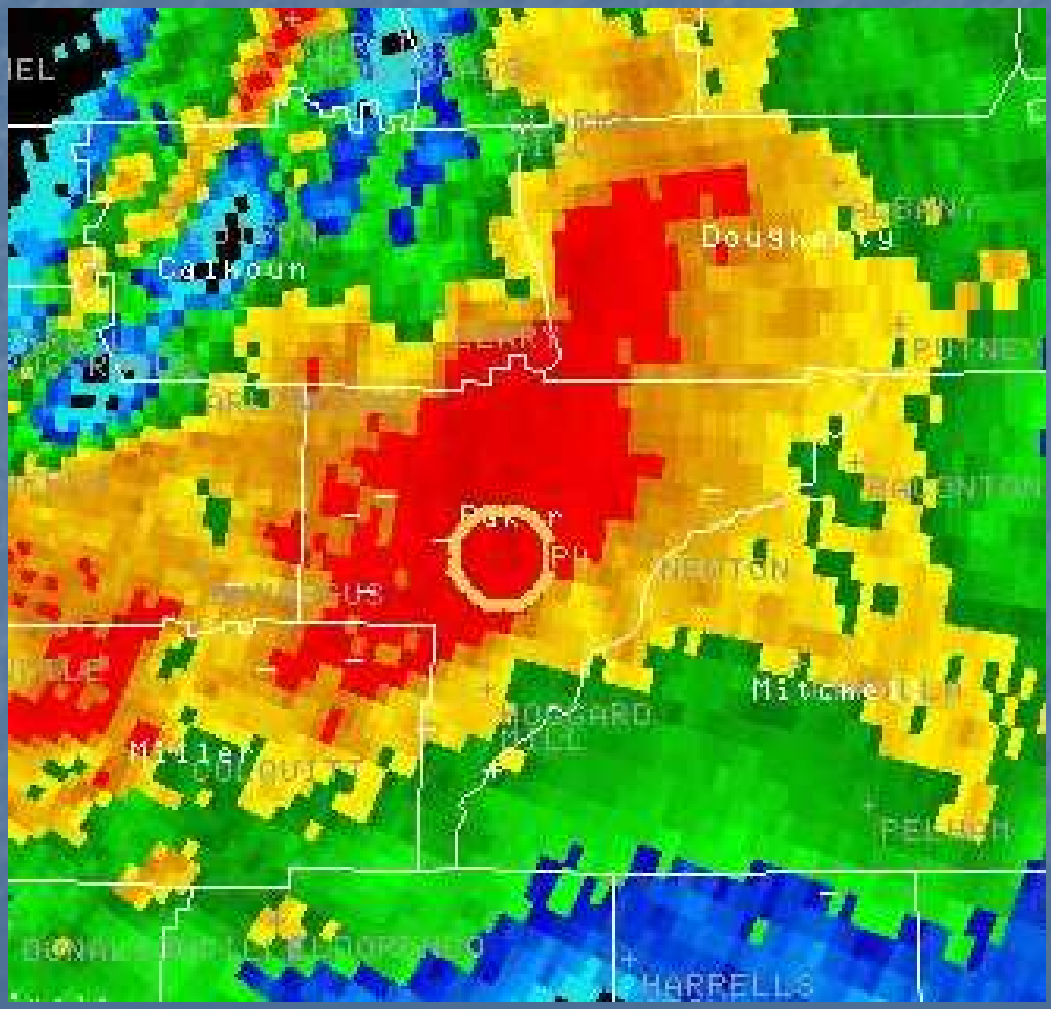


HP Supercell

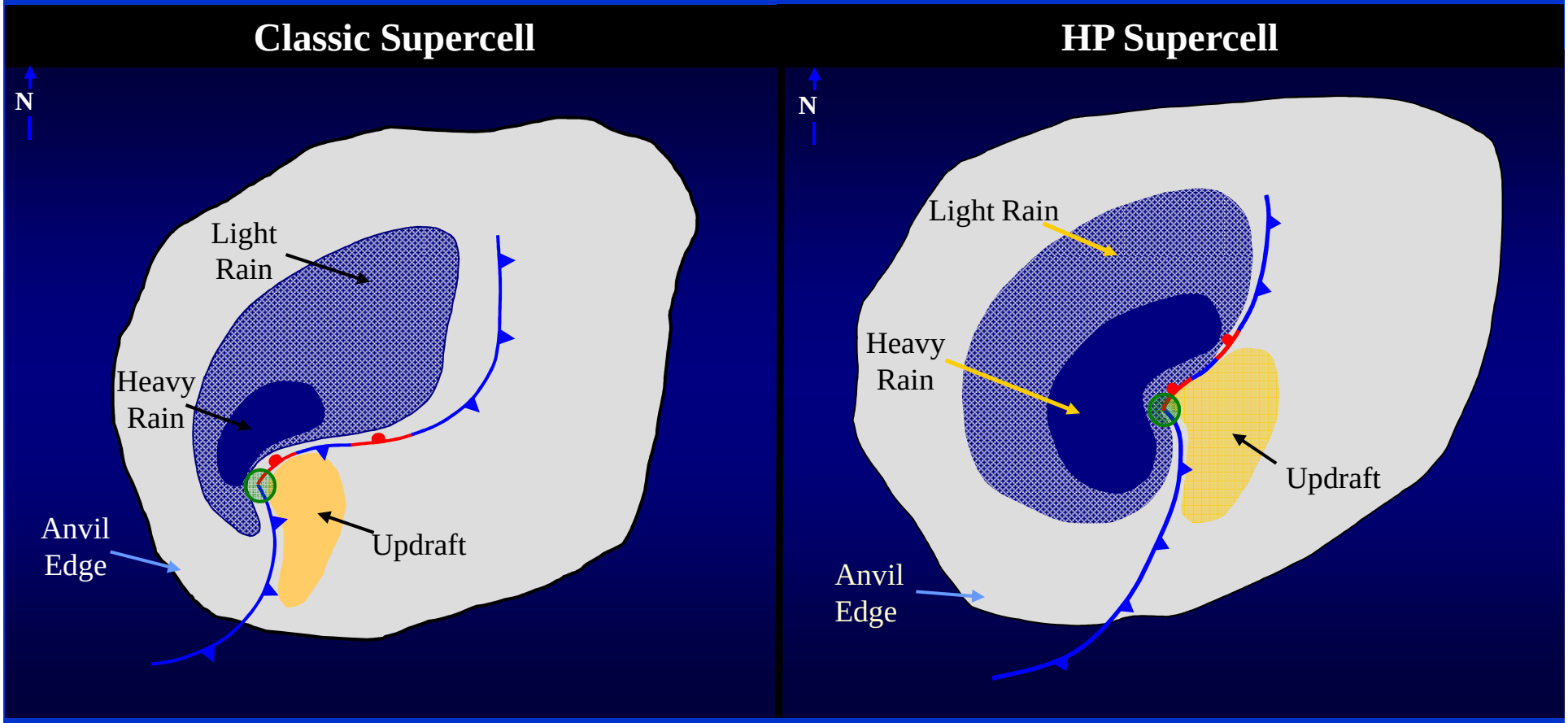




HP Supercell



Classic vs. HP comparison



Top view

Top view

Two Supercell Thunderstorms from the March 1-2, 2007 Tornado Outbreak

Classical Supercell

High Precipitation Supercell

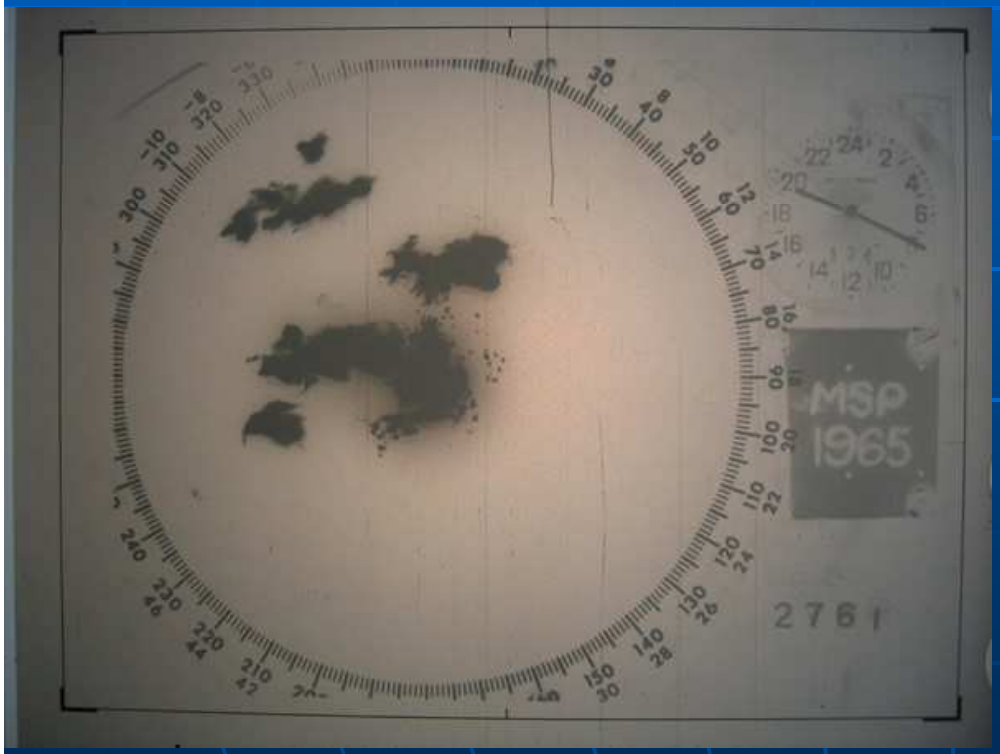
HP Supercell

Midpoint Break

- Do you have any questions?
- We'll take five minutes and let everyone have a break and then finish the presentation with part 2

Radar over the years

1965 Radar Imagery



2007 Radar Imagery

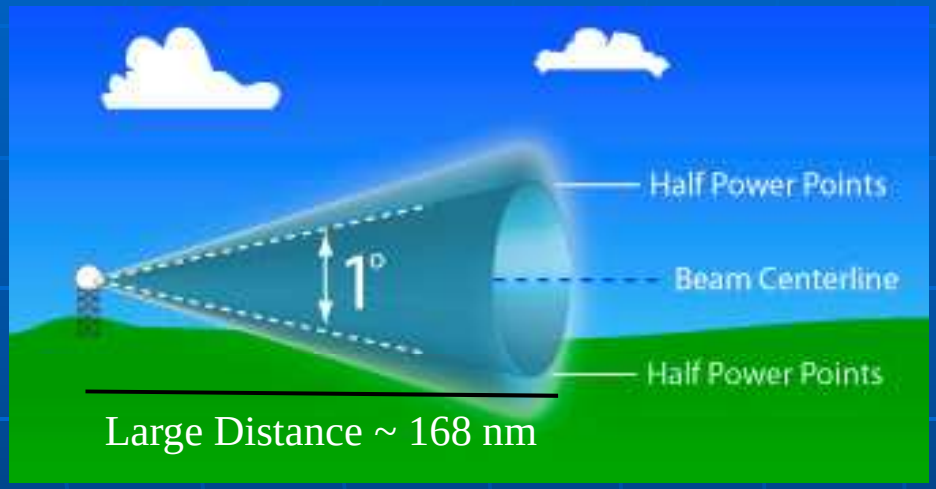
Radar Basics

- NWS Utilizes Doppler Radar to detect meteorological and non-meteorological returns.
- Radars emit a pulse of electromagnetic energy that scatter upon hitting particles in the atmosphere.
- After scattering, some of this energy is returned to the radar and the “image” is produced

Radar Beam

- Emitted energy travels until a particle (rain, dust, etc) is encountered
- Once hit, energy is scattered in all directions
- Some (weakened) energy returns to the radar and the strength of this return determines what we see on the radar

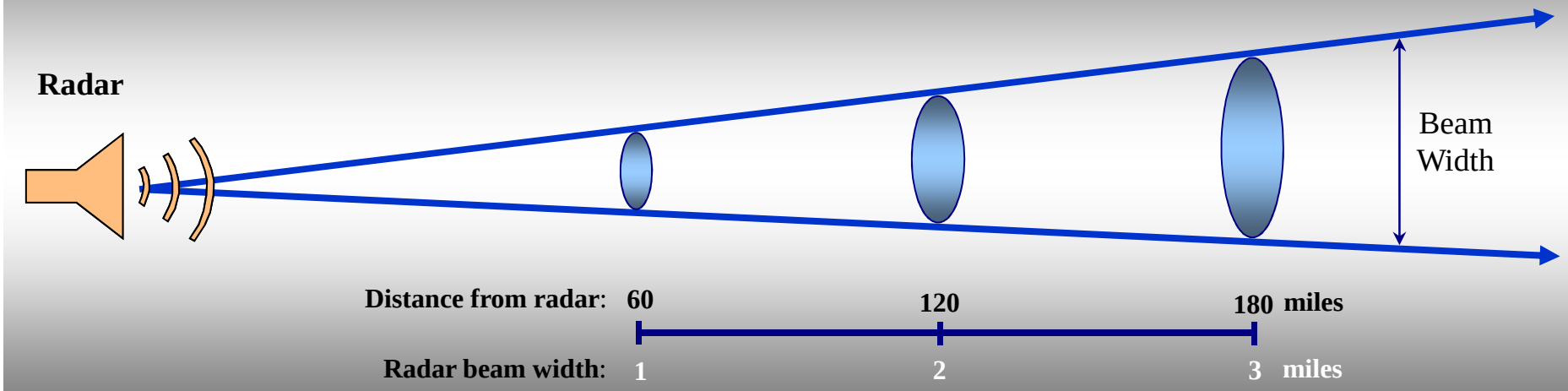
Radar Beam



- The radar beam spreads out when travelling away from the radar site. This can be thought of as a cone shape beam
- As a result, less detail about a storm is observed at greater ranges.
- Storms especially close to the radar also suffer from too little detail.

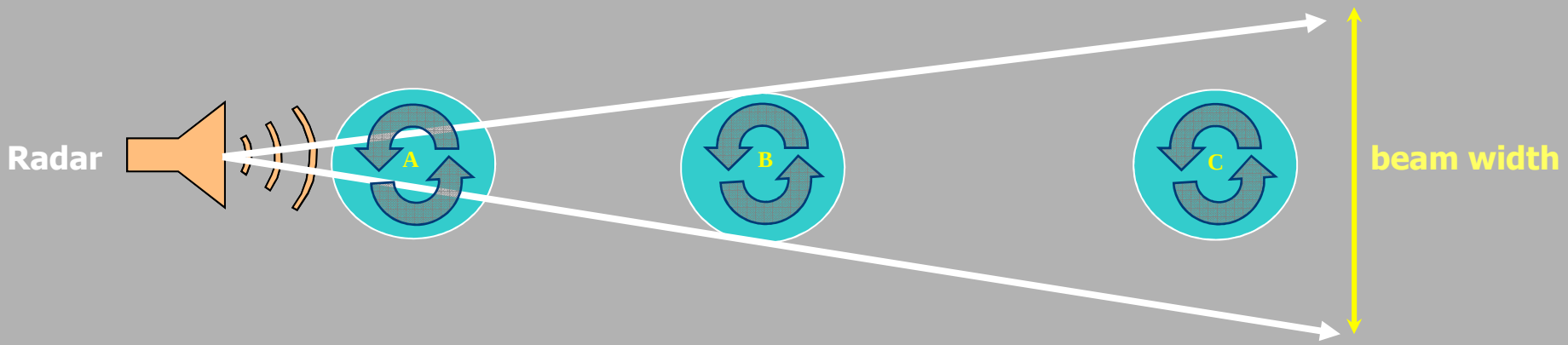
Why we need spotters

Beam width vs. range



Why we need spotters

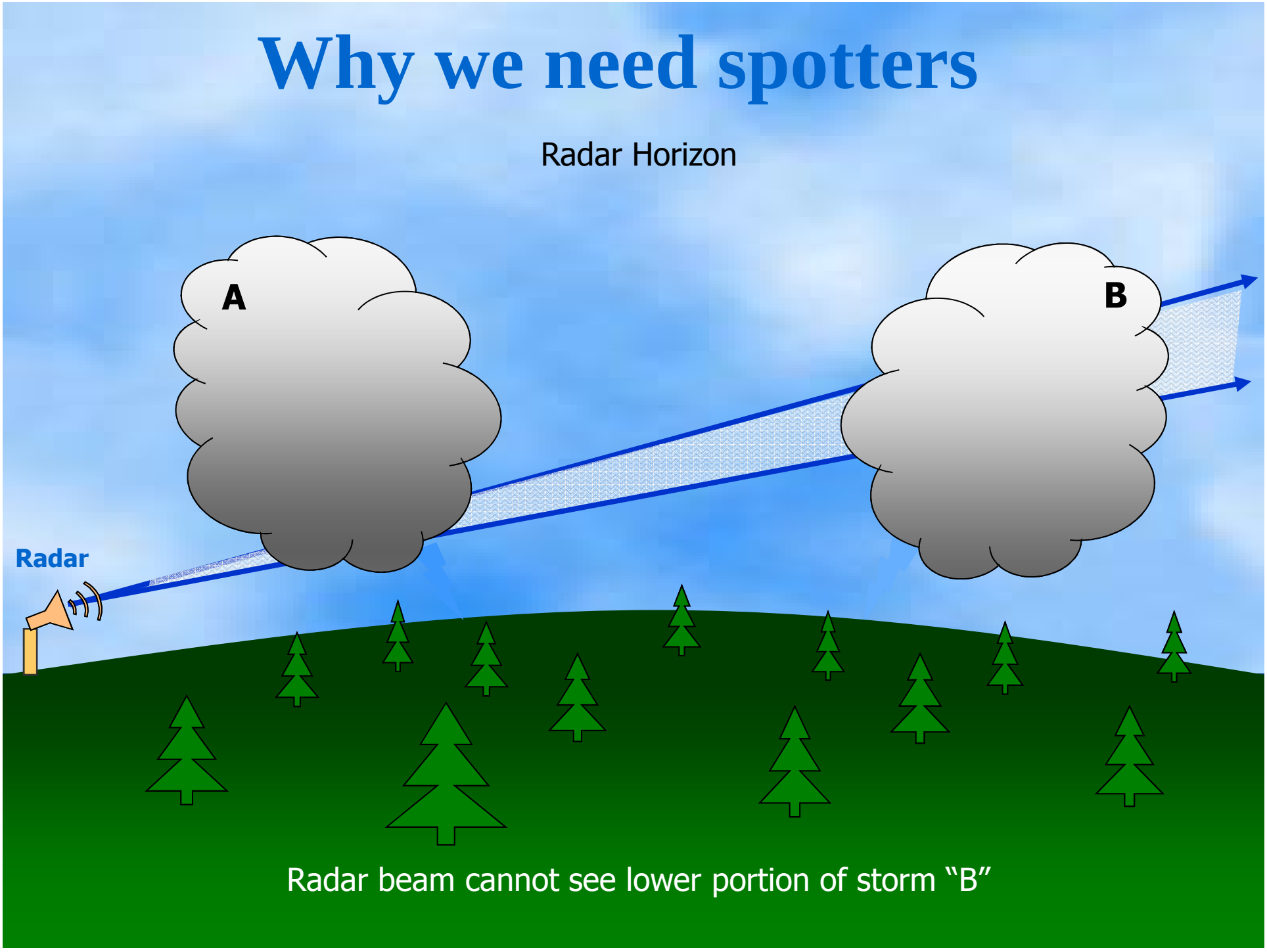
Distance vs. effective resolution



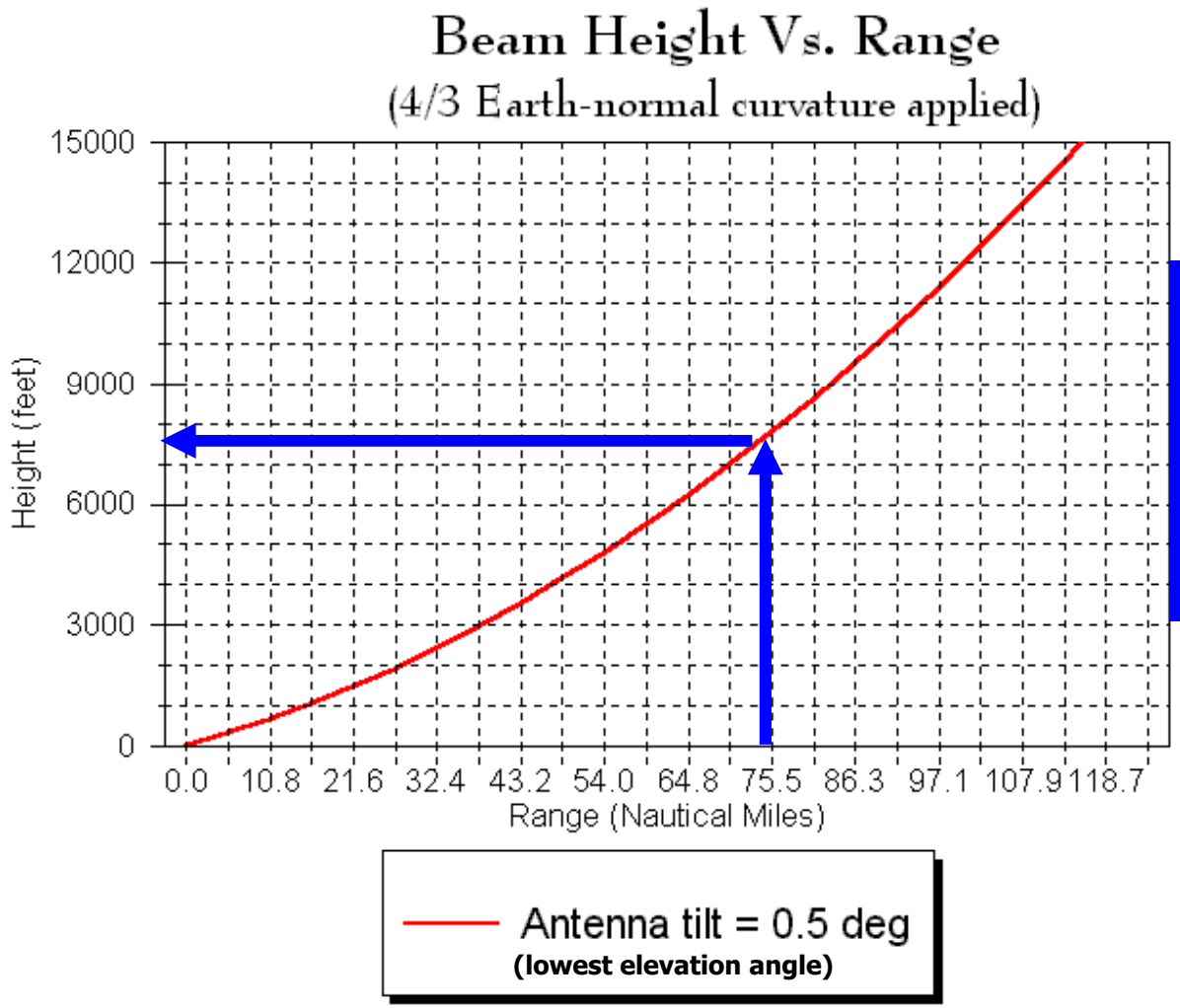
Aspect Ratio Problem

View from above

Why we need spotters



Why we need spotters

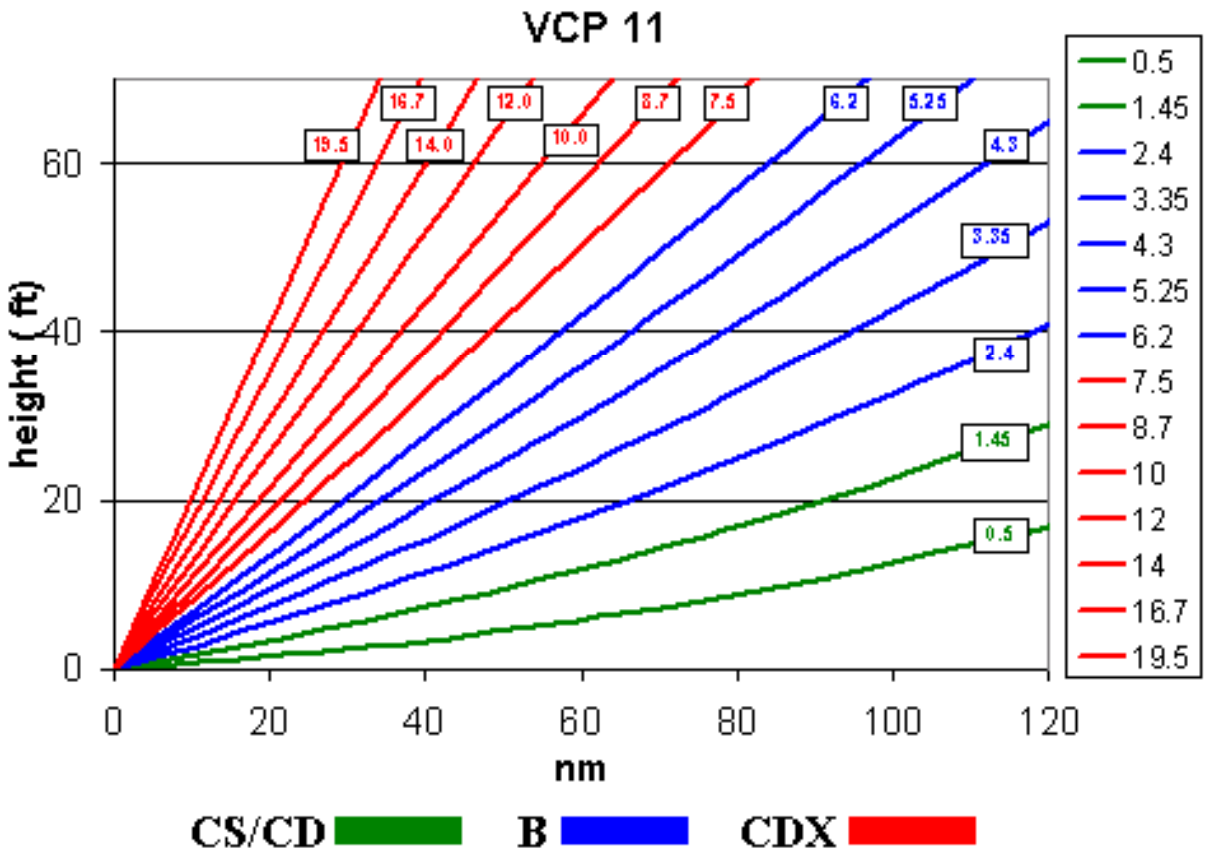


At a distance of 75 miles, the radar is looking 7,600 feet above the ground.

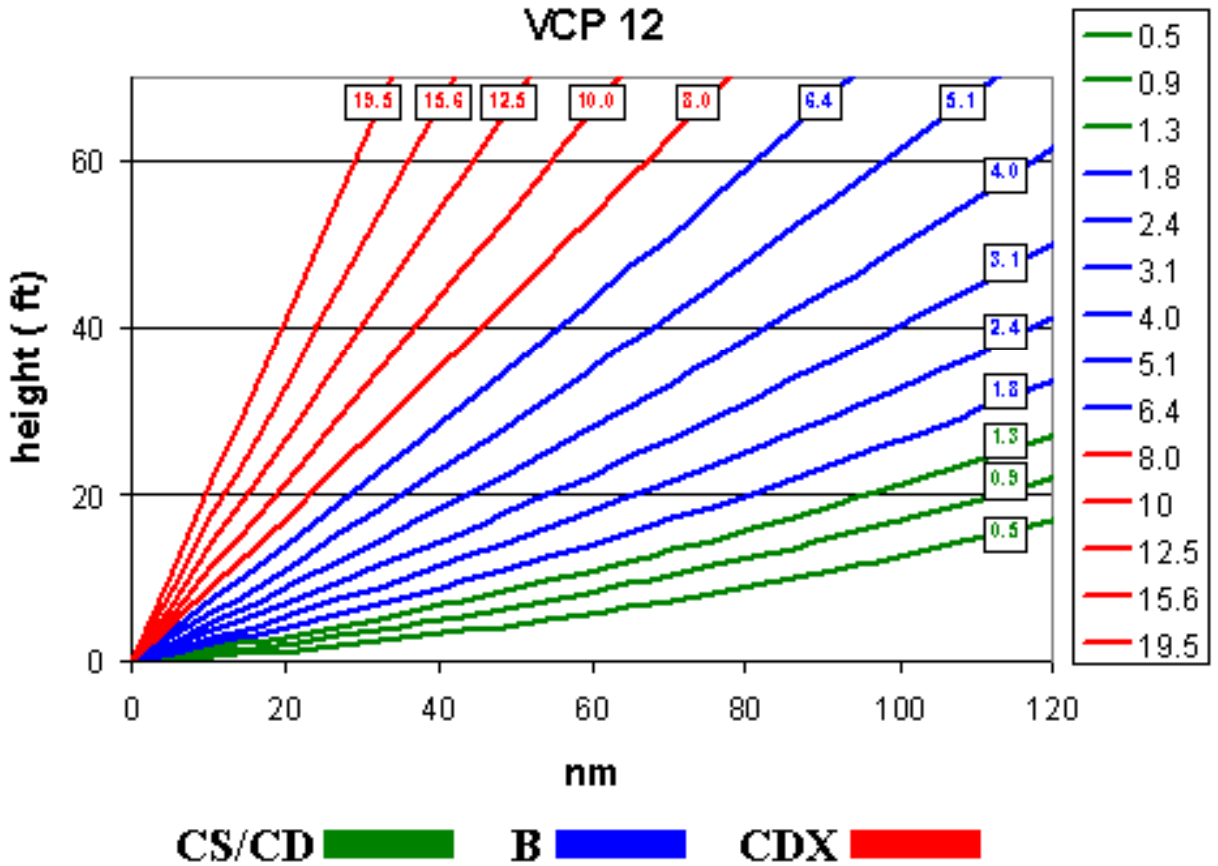
Radar Coverage Patterns

- Meteorologists determine based on each situation which radar coverage pattern (referred to as VCP, or Volume Coverage Pattern) to use for each weather event.
- Each one of these has a strengths and weakness that must be considered before use.

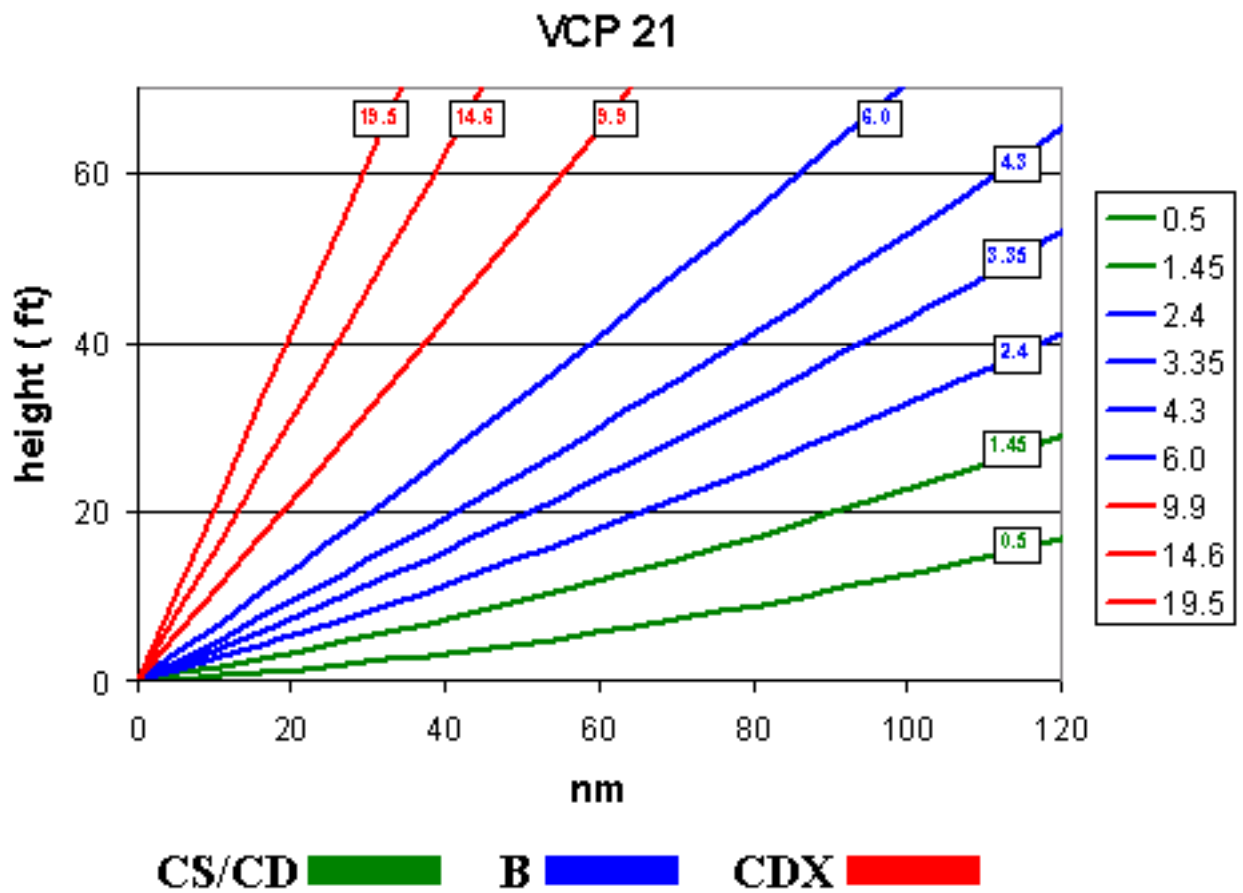
VCP 11


VCP 11
height (ft)
0
20
40
60
0
20
40
60
80
100
120
nm
19.5
16.7
14.0
12.0
10.0
8.7
7.5
6.2
5.25
4.3
3.35
2.4
1.45
0.5
0.5
1.45
2.4
3.35
4.3
5.25
6.2
7.5
8.7
10
12
14
16.7
19.5
CS/CD
B
CDX

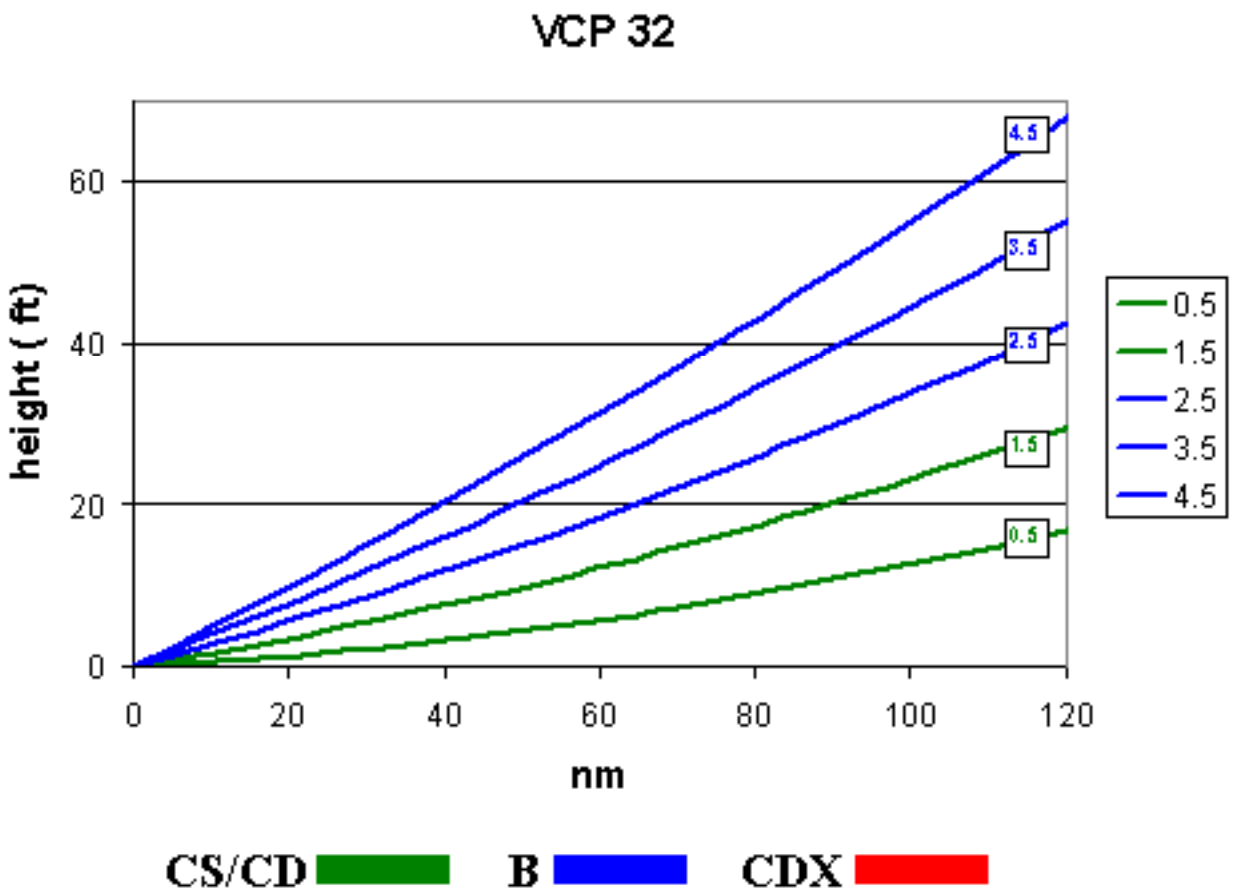
VCP 12

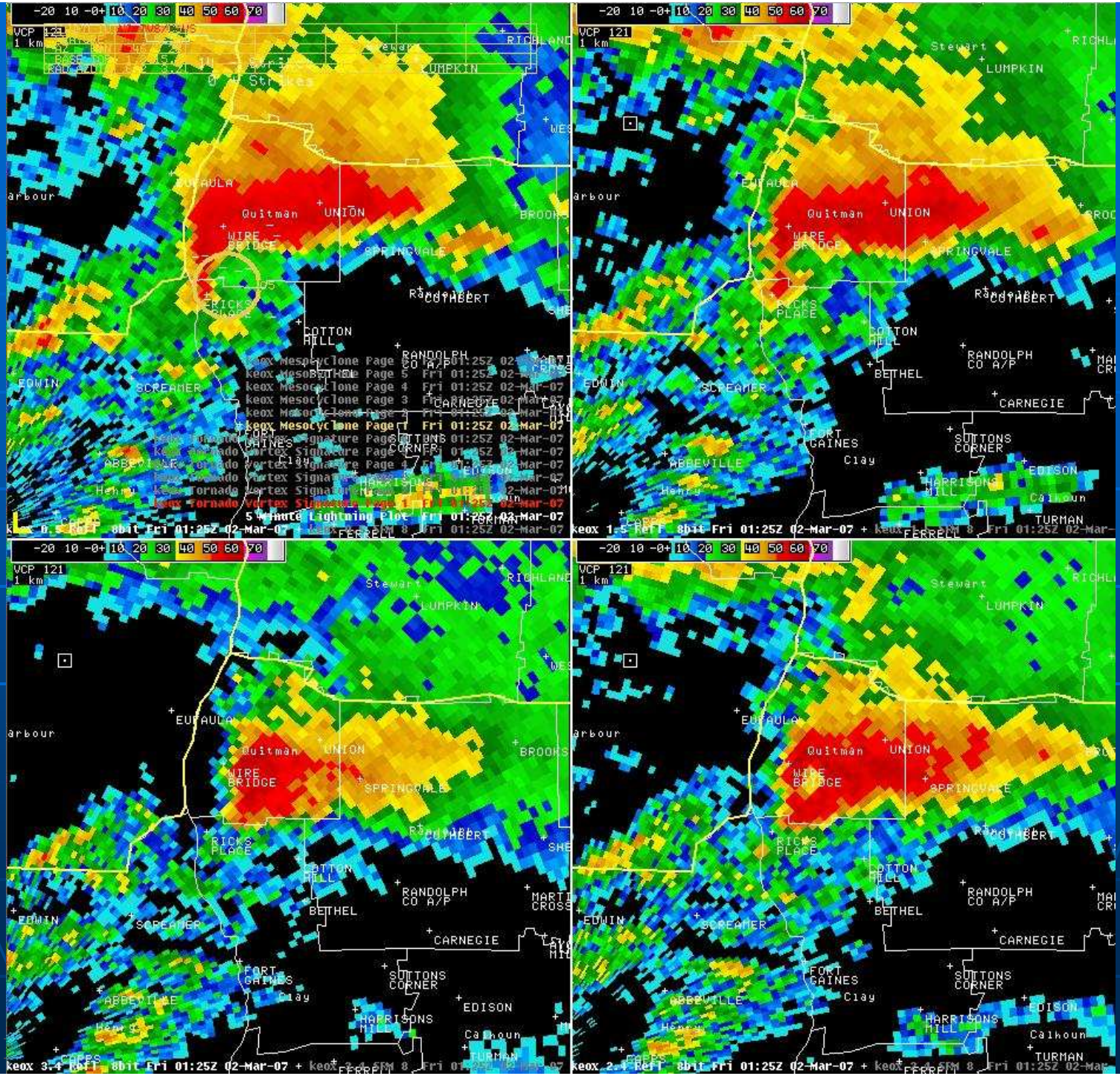

VCP 12
height (ft)
nm
0
20
40
60
80
100
120
0
20
40
60
19.5
15.6
12.5
10.0
8.0
6.4
5.1
4.0
3.1
2.4
1.8
1.3
0.9
0.5
0.5
0.9
1.3
1.8
2.4
3.1
4.0
5.1
6.4
8.0
10
12.5
15.6
19.5
CS/CD
B
CDX

VCP 21


VCP 21
height (ft)
0
20
40
60
0
20
40
60
80
100
120
nm
19.5
14.6
9.9
6.0
4.3
3.35
2.4
1.45
0.5
0.5
1.45
2.4
3.35
4.3
6.0
9.9
14.6
19.5
CS/CD
B
CDX

VCP 32


VCP 32
height (ft)
0
20
40
60
0
20
40
60
80
100
120
nm
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5
CS/CD
B
CDX


-20 10 -0+ 10 20 30 40 50 60 70
VCP 121
1 km
Stewart
LUMPKIN
RICHLAND
EUFAULA
Quitman
UNION
WIRE BRIDGE
SPRINGVALE
BROOKS
RICKS PLACE
CUTHBERT
COTTON HILL
RANDOLPH CO A/P
EDWIN
SCREAMER
BETHEL
CARNEGIE
FORT GAINES
SUTTONS CORNER
ABBEVILLE
Clay
HARRISONS MILL
EDISON
Calhoun
TURMAN
FERRELL
Keox Mesocyclone Page 5 Fri 01:25Z 02-Mar-07
Keox Mesocyclone Page 4 Fri 01:25Z 02-Mar-07
Keox Mesocyclone Page 3 Fri 01:25Z 02-Mar-07
Keox Mesocyclone Page 2 Fri 01:25Z 02-Mar-07
Keox Mesocyclone Page 1 Fri 01:25Z 02-Mar-07
Keox Tornado Vortex Signature Page 5 Fri 01:25Z 02-Mar-07
Keox Tornado Vortex Signature Page 4 Fri 01:25Z 02-Mar-07
Keox Tornado Vortex Signature Page 3 Fri 01:25Z 02-Mar-07
Keox Tornado Vortex Signature Page 2 Fri 01:25Z 02-Mar-07
Keox Tornado Vortex Signature Page 1 Fri 01:25Z 02-Mar-07
5 Minute Lightning Plot Fri 01:25Z 02-Mar-07
keox 0.5 Refl 8bit Fri 01:25Z 02-Mar-07
keox 1.5 Refl 8bit Fri 01:25Z 02-Mar-07
keox 3.4 Refl 8bit Fri 01:25Z 02-Mar-07
keox 2.4 Refl 8bit Fri 01:25Z 02-Mar-07

Why we need spotters

Beam width vs.
effective resolution

Storm 20 miles from radar

Same storm 80 miles from radar

Why we need spotters

Storm Orientation relative to radar
55 miles from Both Radars

Storm Down Radial KEOX

Storm Perpendicular to Radial KTLH

Why we need spotters

Storm Orientation relative to radar
55 miles from Both Radars

Storm Down Radial KEOX

Storm Perpendicular to Radial KTLH

Not all tornadoes look the same on radar!

This is the radar image when a tornado came ashore and caused some moderate damage to the community of Apalachicola. This tornado producing thunderstorm looks much weaker compared to the storms just shown on the previous slide.

Reflectivity (KTLH)

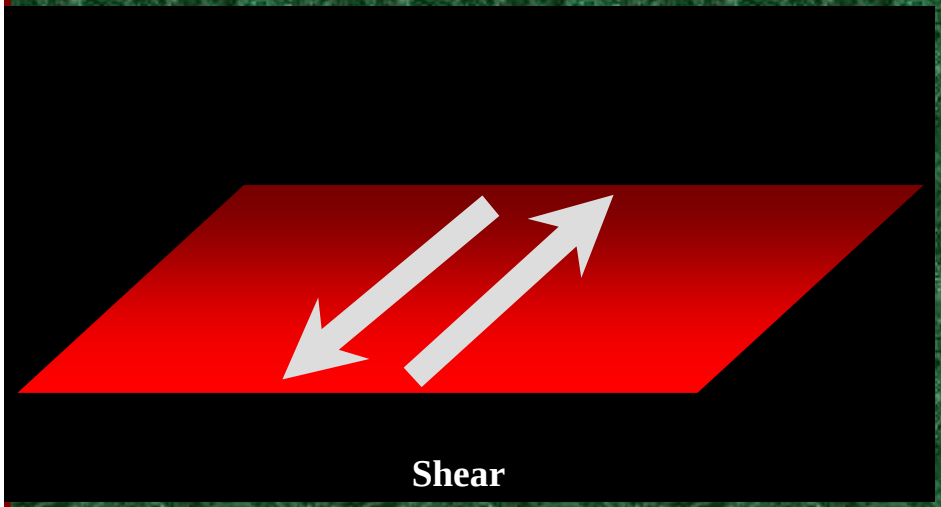
Storm Relative Motion (KTLH)

Final thoughts on Doppler Radar

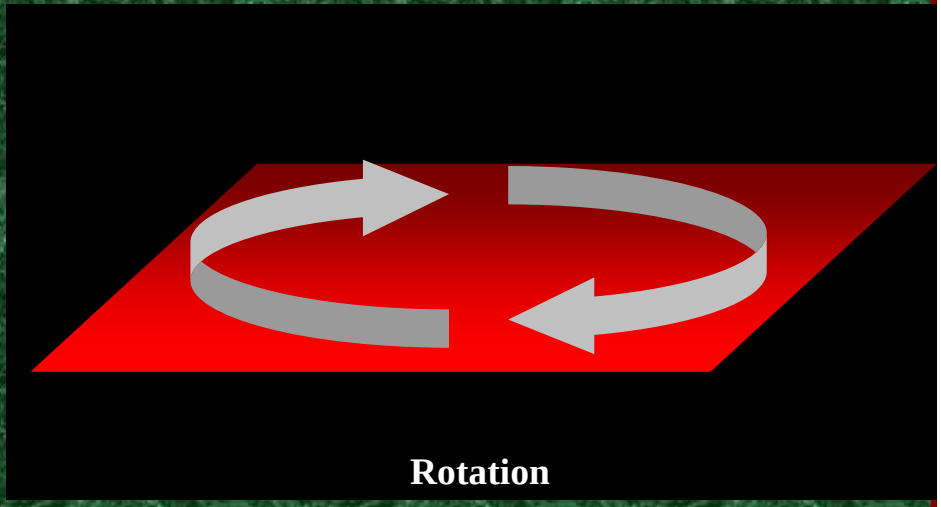
•This process of emitting a signal, listening for any returned signal, then emitting the next signal, takes place very fast, up to around 1300 times each second.

• Much of the process is spent “listening” for returning energy.

Shear vs. Rotation

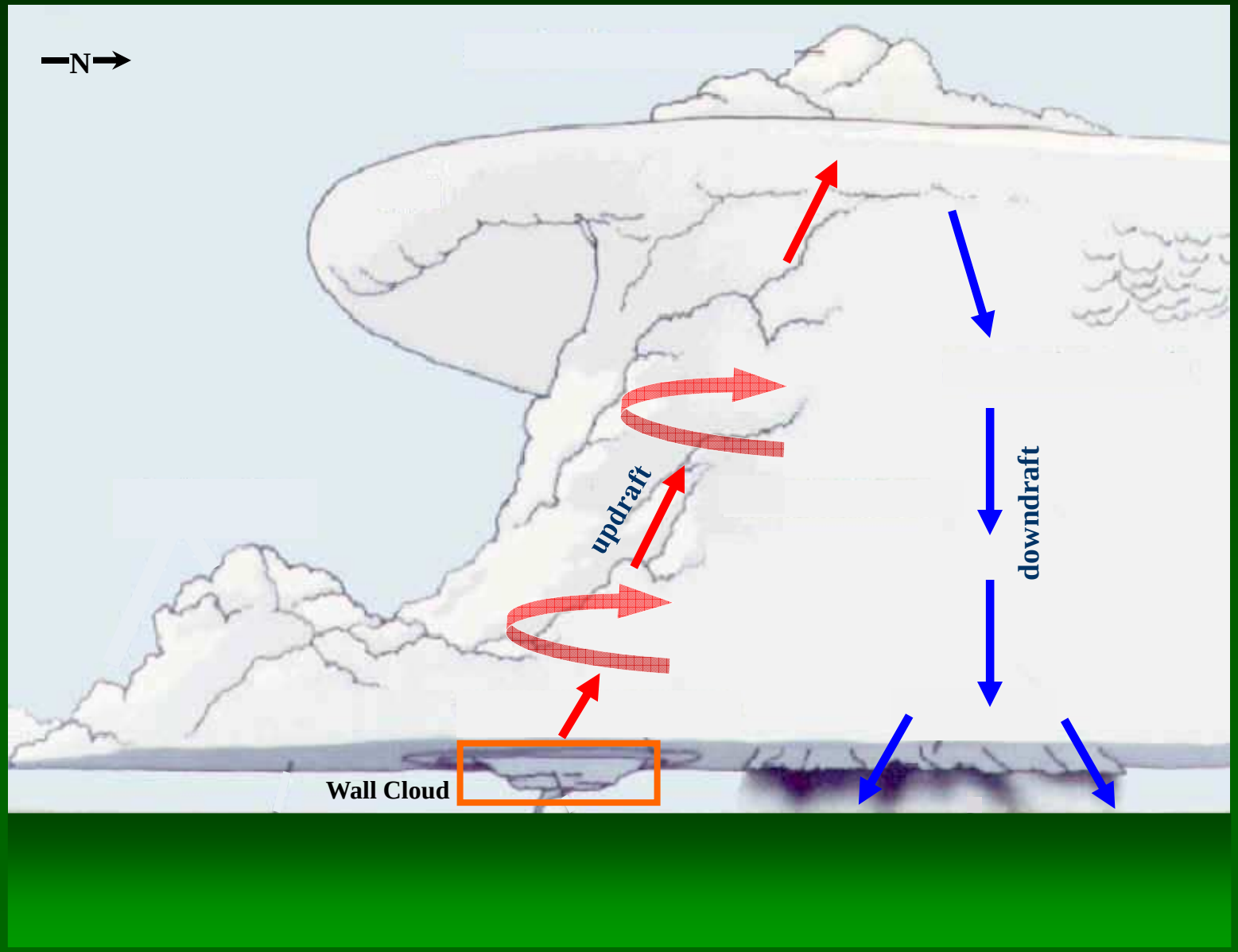


Shear



Rotation

Wall Clouds



Wall Cloud Characteristics

> Surface based inflow under the updraft

> Attached to cloud base

> Look for persistence

> May or may not rotate

>Look for vertical cloud motion

>Often slopes or points toward precipitation or downdraft

Wall Cloud

Wall Cloud

Funnel Clouds

> A rotating, funnel-shaped cloud extending downward from a thunderstorm base.

> Usually located near updraft but can be found anywhere

> Attached to cloud base

> Exhibit rapid rotation and are most often laminar or smooth in appearance

> Do not reach ground

Tornado

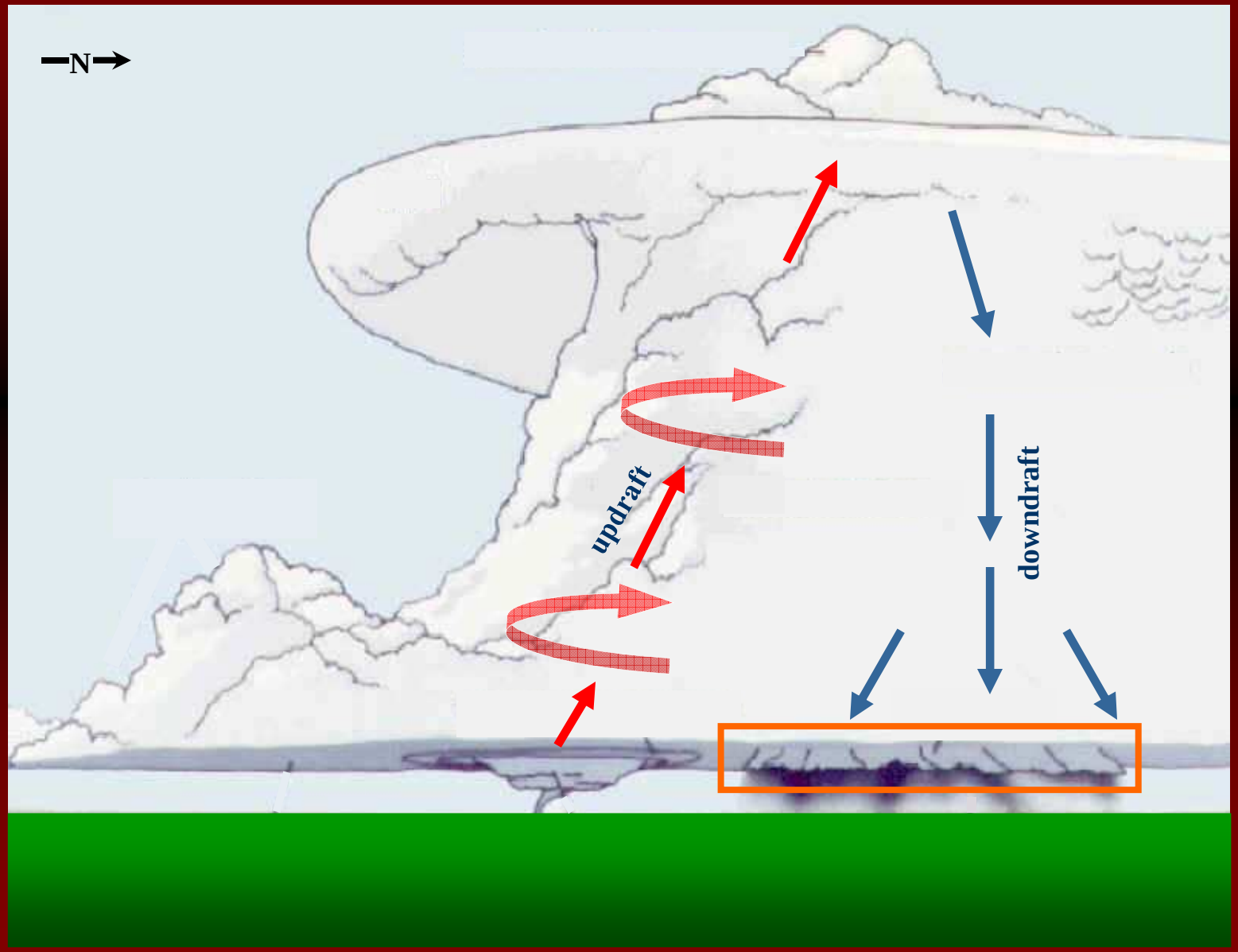
A violently rotating column of air extending

from cloud base to the ground.

Funnel Cloud

Funnel Cloud/Tornado

Shelf Clouds



Shelf Clouds

-Marks the leading edge of the gust front

-Usually produced by rain cooled air

-Usually in area of low level shear

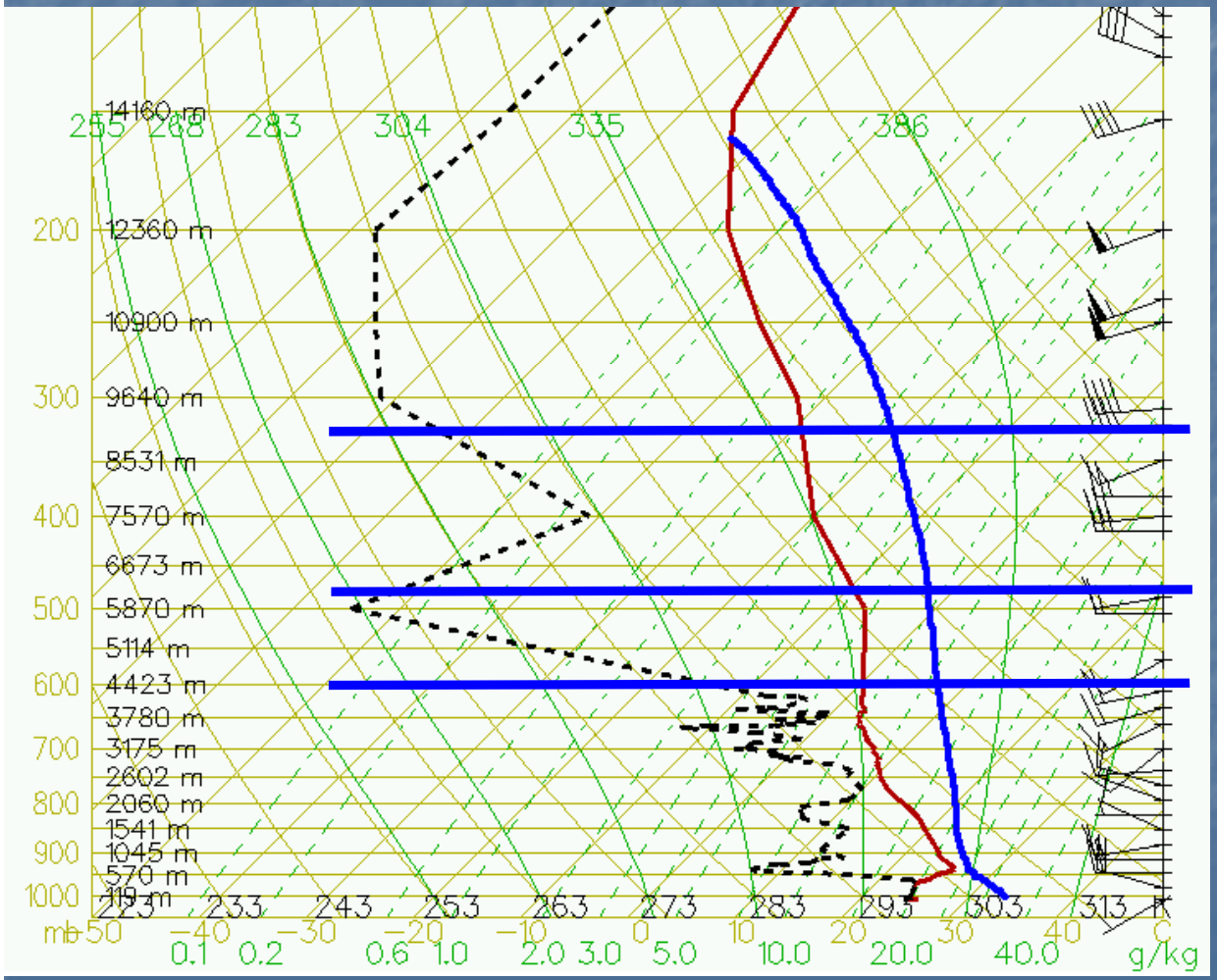
-Slope down away from precipitation area

-Often associated with a squall line- can be associated with gustnadoes or damaging straight-line wind

Shelf Clouds

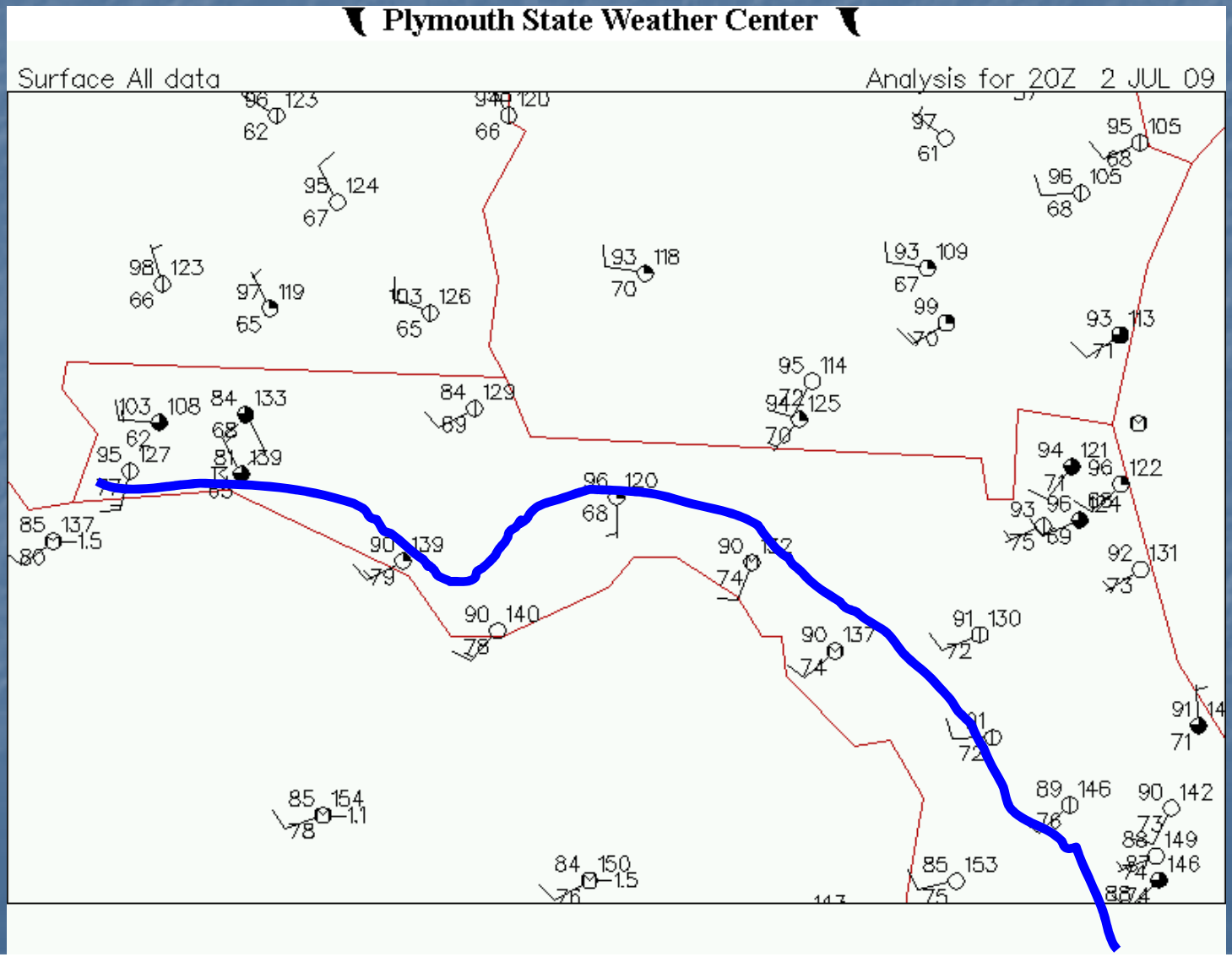
National Weather Service www.weather.gov

Case Study – Summer

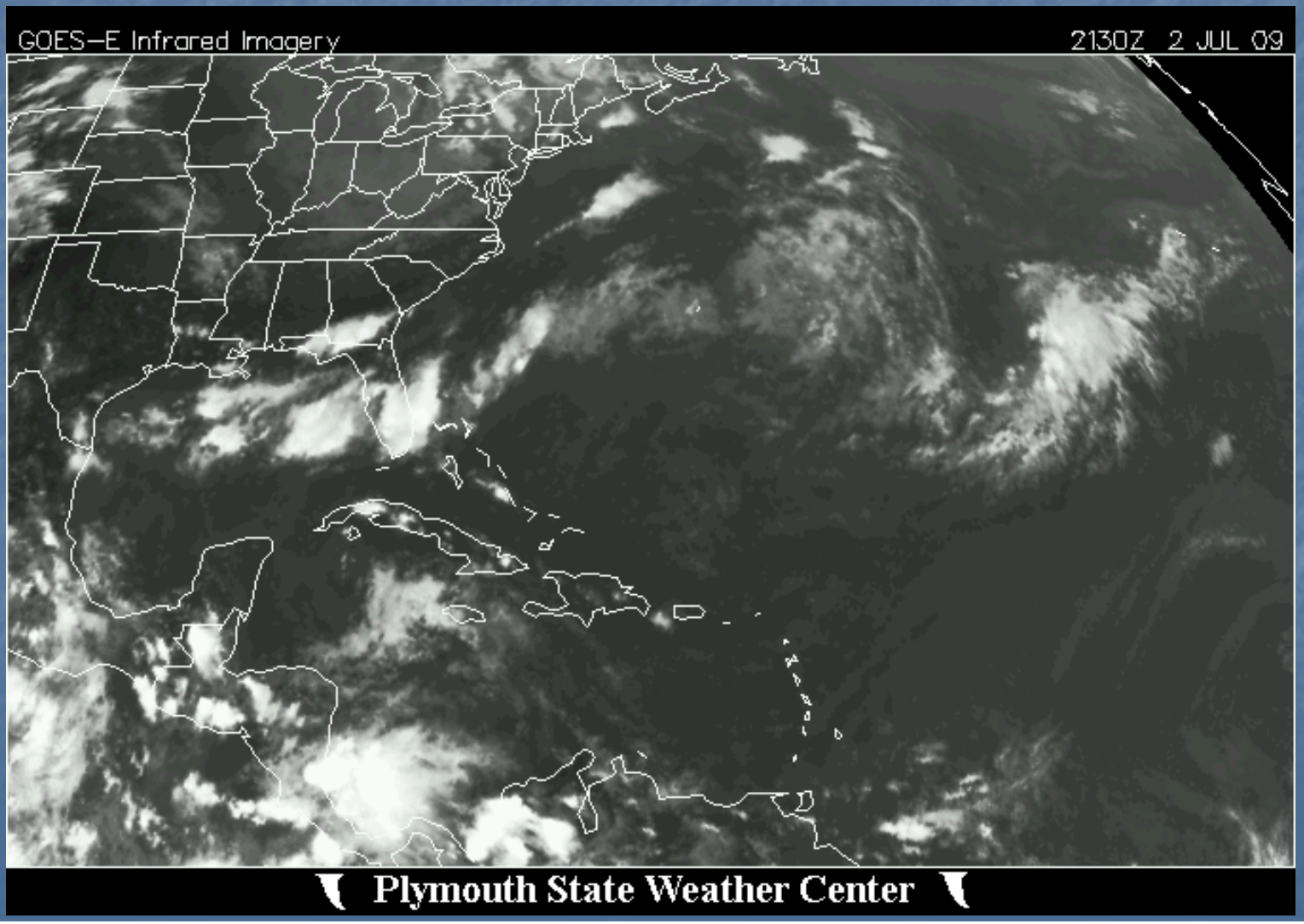


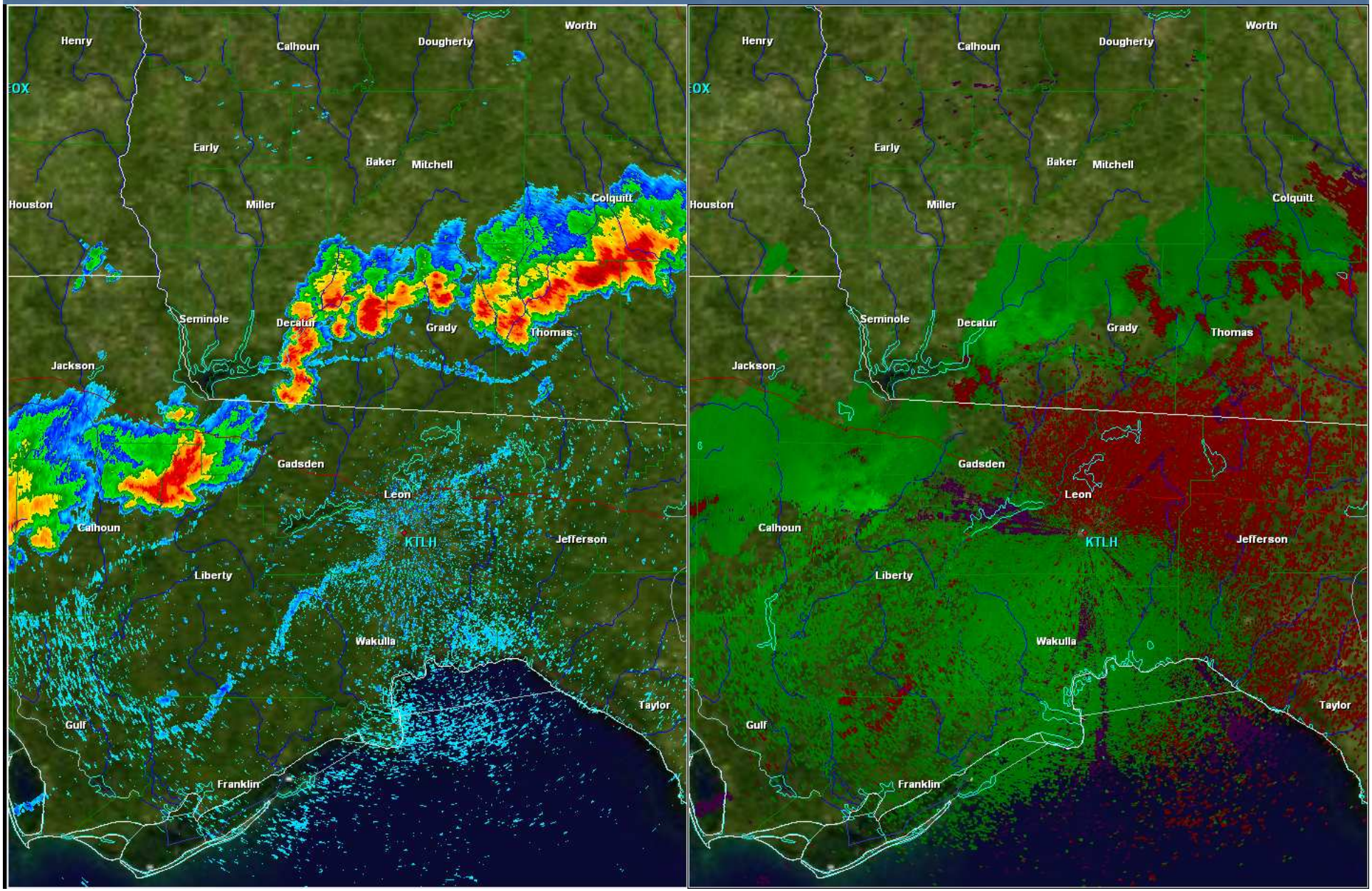
- CAPE Relatively High, especially in hail growth zone.
- 700-500 mb dewpoint depressions elevated
- Convergent flow relative to sea breeze boundaries (West, Northwest, Northeast, East)

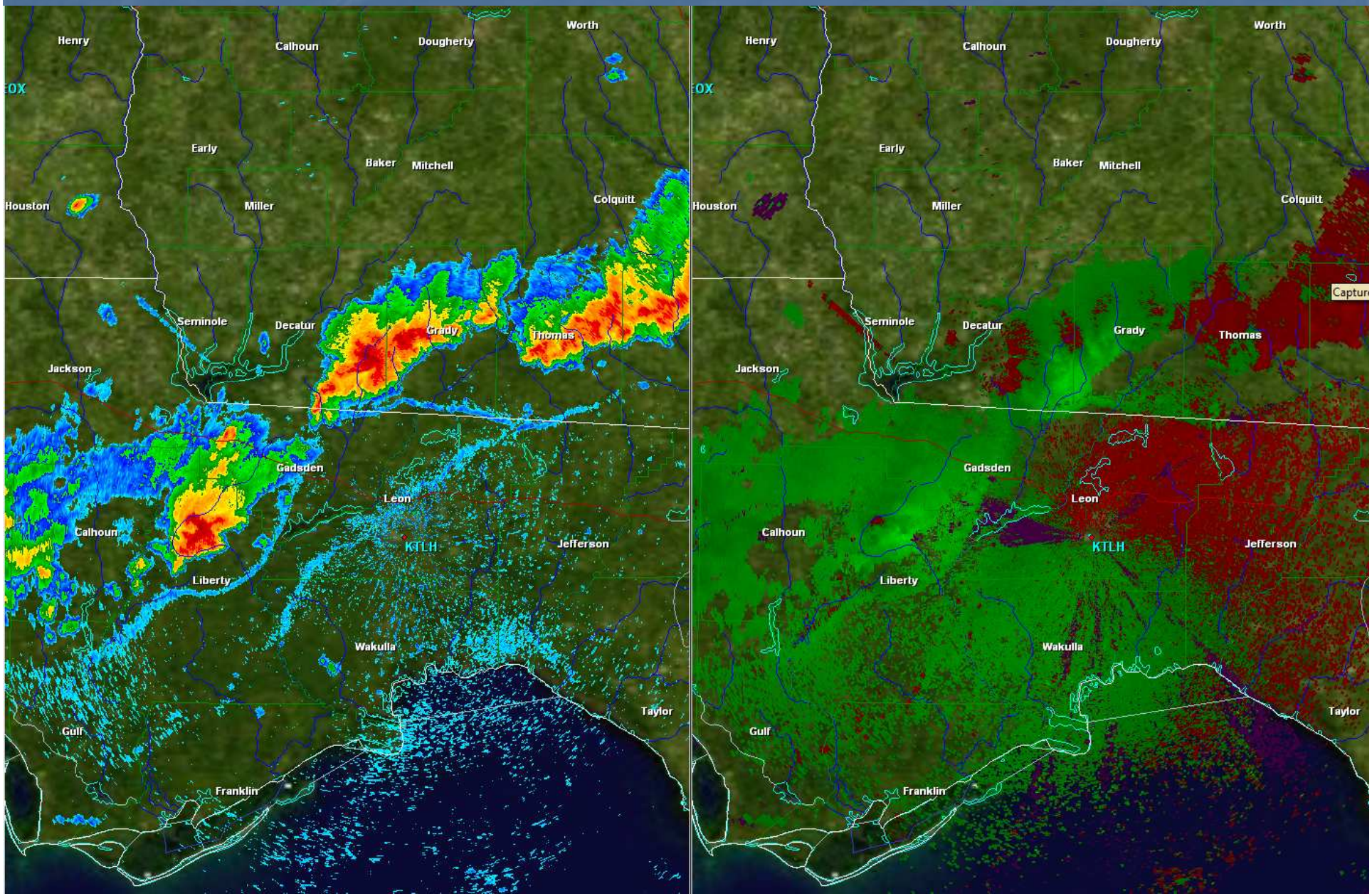
Surface Chart – 4 pm ET

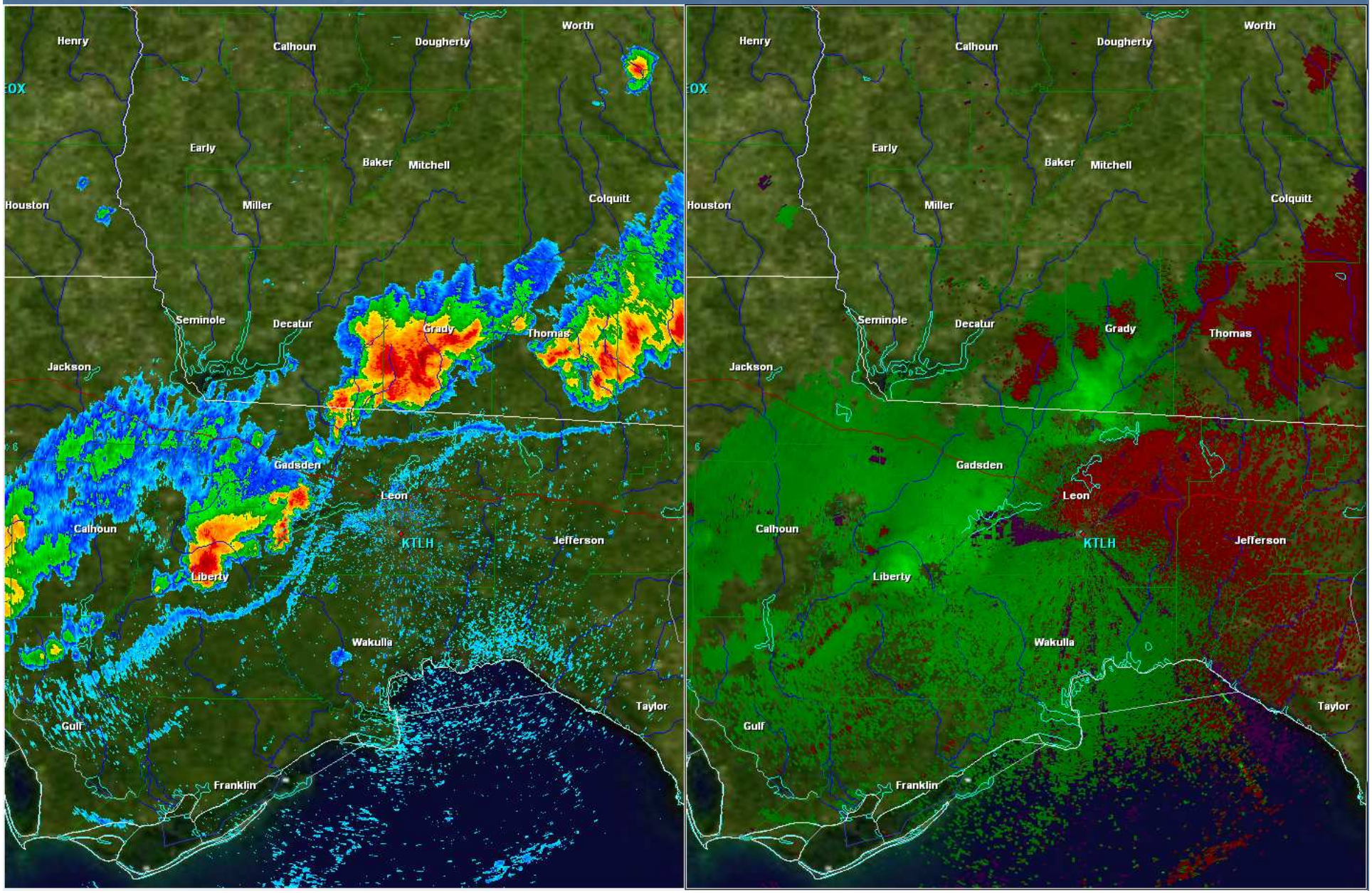


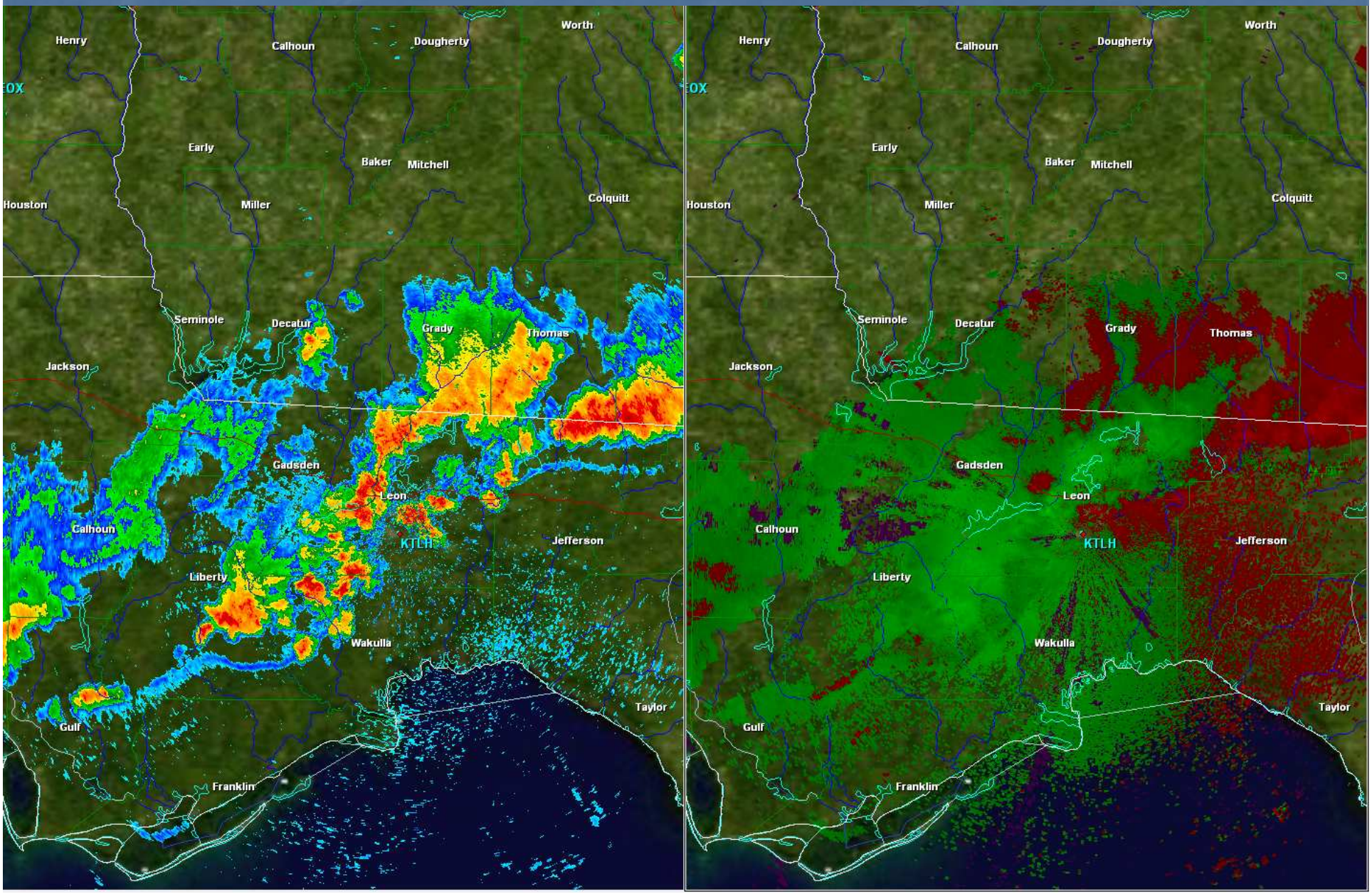
Satellite Imagery – 530 pm ET

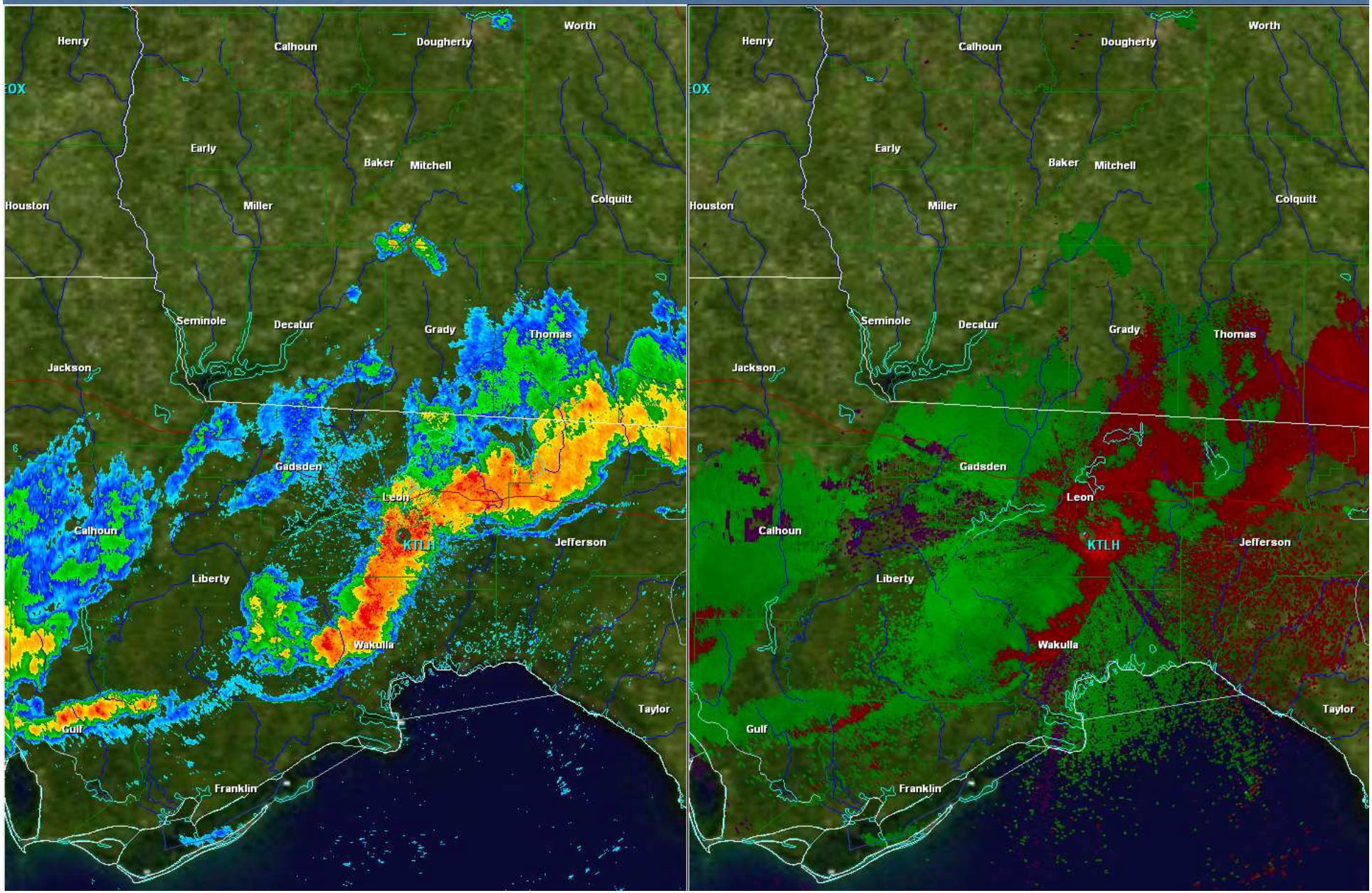


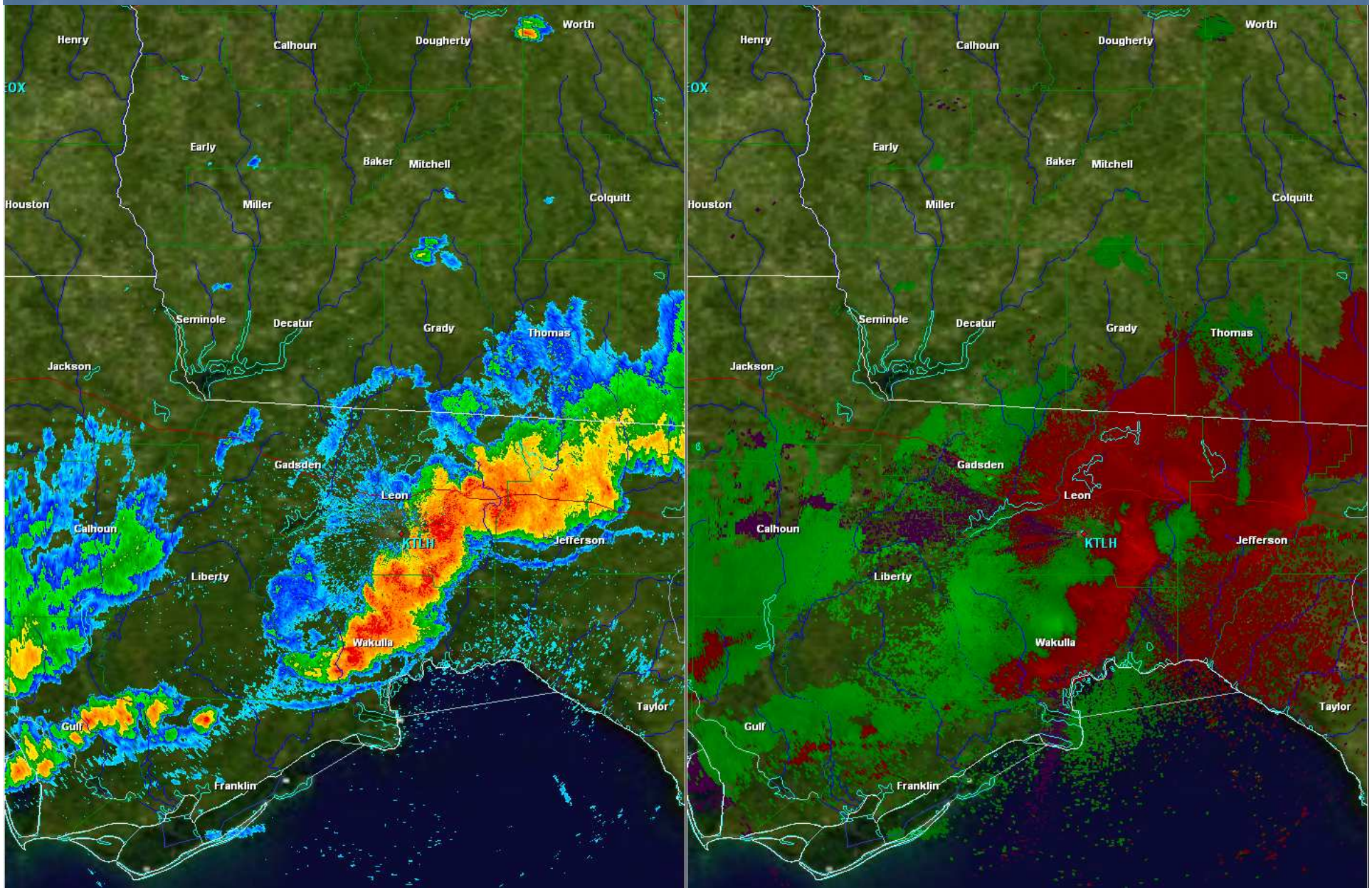

Henry
Calhoun
Dougherty
Worth
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin

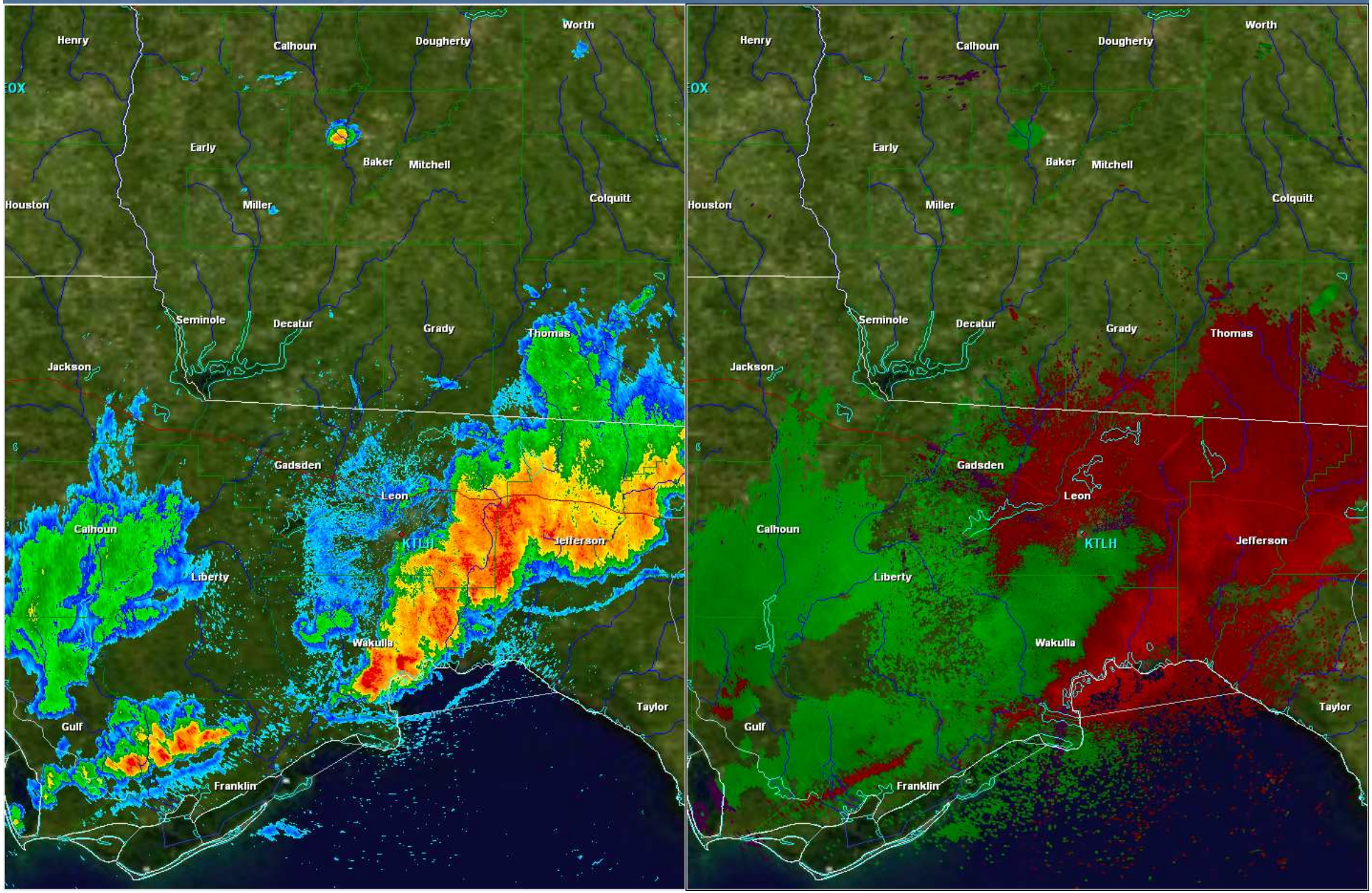

Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin
Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin


Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin


Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin
Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin


Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin


Henry
Calhoun
Dougherty
Worth
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin


Henry
Calhoun
Dougherty
Worth
EOX
Early
Baker
Mitchell
Houston
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Jackson
Gadsden
Leon
Calhoun
KTLH
Jefferson
Liberty
Wakulla
Taylor
Gulf
Franklin

Damage Assessment

- NWS provides official assessment of severe storms and tornadoes
- We appreciate estimates of wind speeds from spotters when sufficient data is available to make that determination
- NWS Meteorologists use the new Enhanced Fujita Scale to make damage assessments

Estimating Wind Speed

25-31 mph - large branches in motion

32-38 mph – whole trees in motion

39-54 mph – twigs break off, wind impedes walking

55-72 mph – damage to chimneys and TV antennas, large branches broken and some trees uprooted

73-112 mph – removes shingles, windows broken, trailer houses overturned, trees uprooted

113+ mph – roofs torn off, weak buildings and trailer houses destroyed, large trees uprooted

Enhanced Fujita Scale

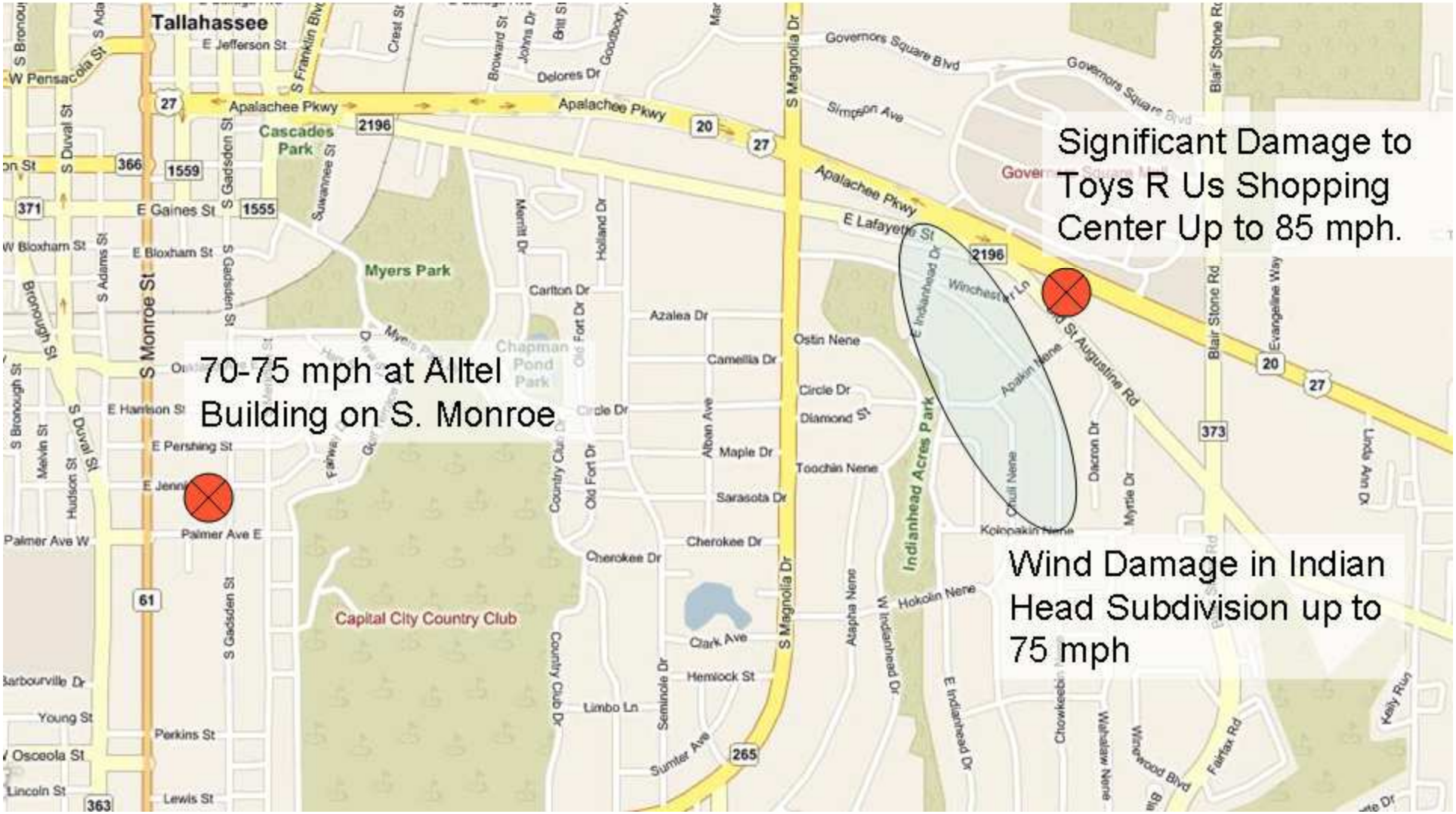
- EF Scale

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
	Fastest 1/4-mile (mph)	3 Second Gust (mph)		3 Second Gust (mph)	**0**	**65-85**
0	40-72	45-78	0	65-85		
1	73-112	79-117	1	86-109	**1**	**86-110**
2	113-157	118-161	2	110-137	**2**	**111-135**
3	158-207	162-209	3	138-167	**3**	**136-165**
4	208-260	210-261	4	168-199	**4**	**166-200**
5	261-318	262-317	5	200-234	**5**	**Over 200**


1801
E

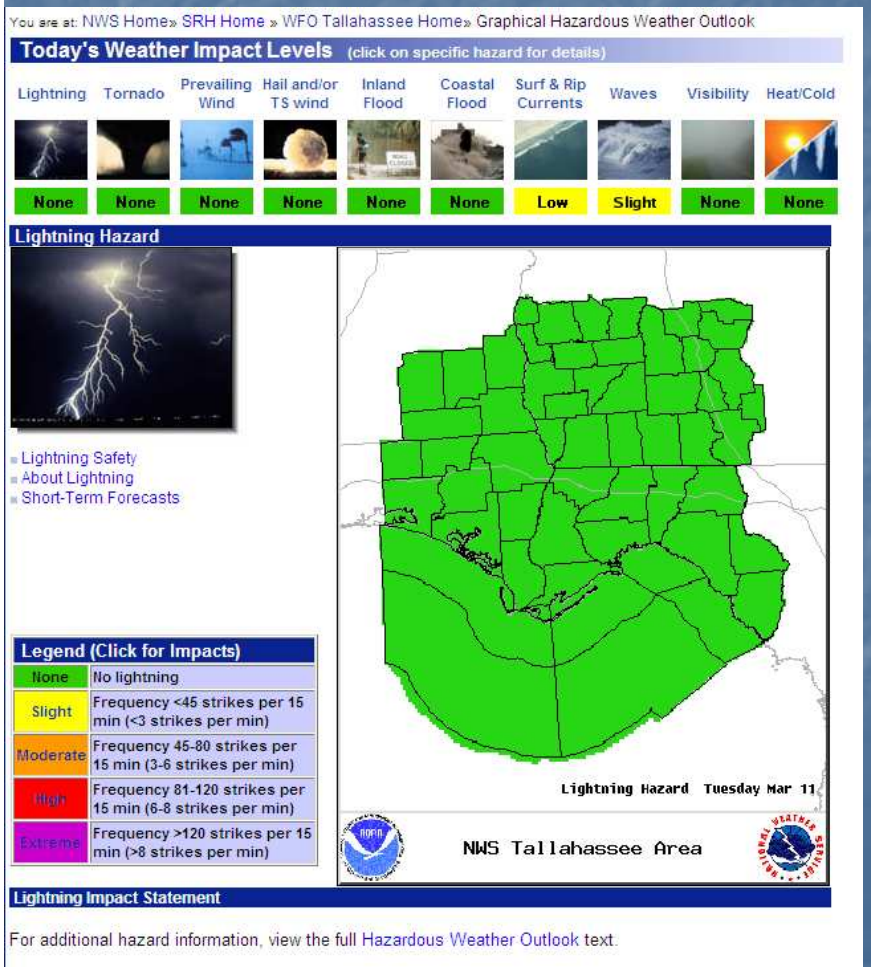
Storm Survey Map from Thursday, June 2, 2009 Storm

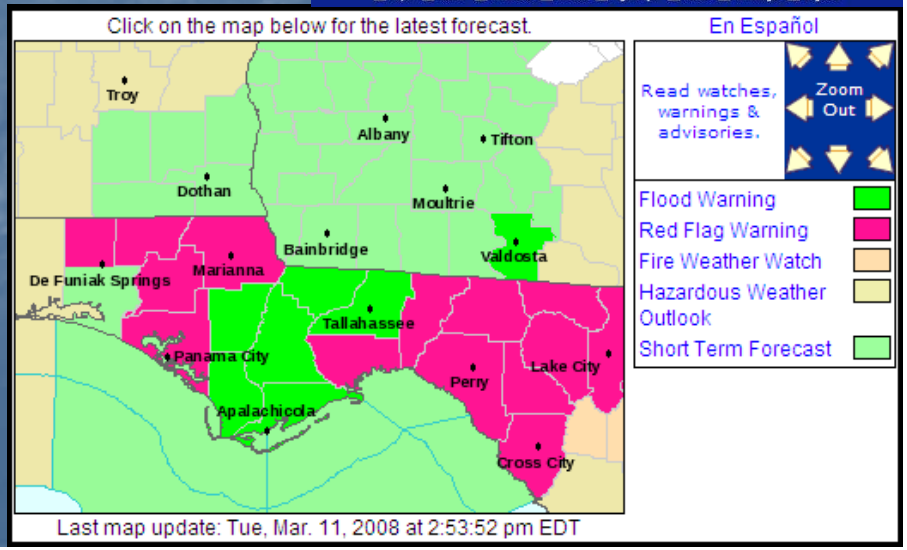
Straight line wind event with maximum winds up to 85 mph. Most concentrated damage was at the Toys R Us Shopping Center near Apalachee Parkway. Maximum damage width was approaching one half mile in Indian Head Subdivision.



Tools to use

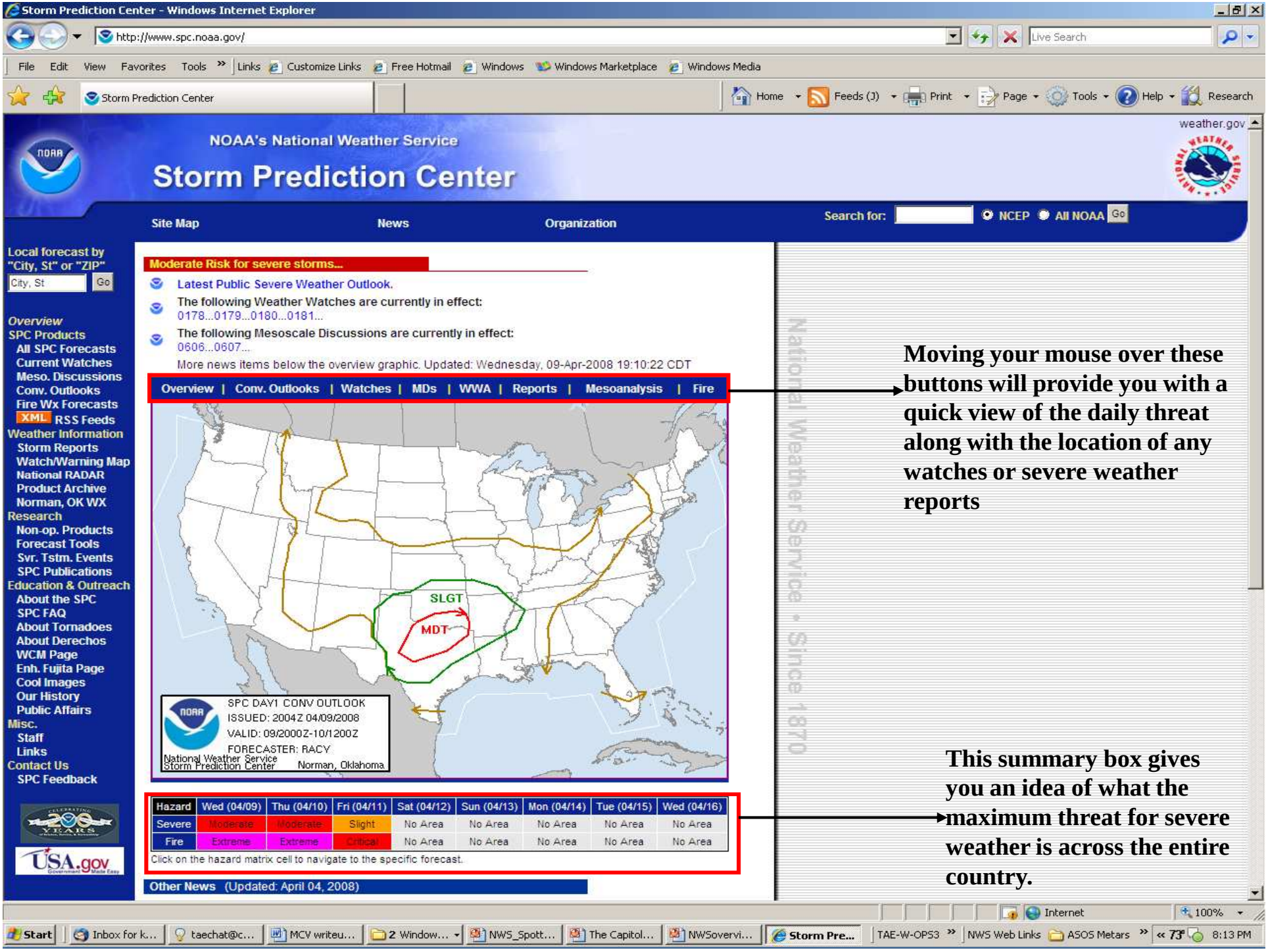
- Our main page: http://www.srh.noaa.gov/tlh
- Graphical Hazardous Weather Outlook
- Ridge Radar Display





Storm Prediction Center

- Provides daily outlook for organized severe weather.
- Outlooks for Day 1, Day 2, Day 3, and Days 4-8 issued daily
- Threat levels of Slight, Moderate, or High
- http://www.spc.noaa.gov


Storm Prediction Center - Windows Internet Explorer
http://www.spc.noaa.gov/
NOAA's National Weather Service
Storm Prediction Center
weather.gov
Site Map
News
Organization
Search for:
NCEP
All NOAA
Go
Local forecast by "City, St" or "ZIP"
City, St
Overview
SPC Products
All SPC Forecasts
Current Watches
Meso. Discussions
Conv. Outlooks
Fire Wx Forecasts
XML RSS Feeds
Weather Information
Storm Reports
Watch/Warning Map
National RADAR
Product Archive
Norman, OK WX
Research
Non-op. Products
Forecast Tools
Svr. Tstm. Events
SPC Publications
Education & Outreach
About the SPC
SPC FAQ
About Tornadoes
About Derechos
WCM Page
Enh. Fujita Page
Cool Images
Our History
Public Affairs
Misc.
Staff
Links
Contact Us
SPC Feedback
Moderate Risk for severe storms...
Latest Public Severe Weather Outlook.
The following Weather Watches are currently in effect:
0178...0179...0180...0181...
The following Mesoscale Discussions are currently in effect:
0606...0607...
More news items below the overview graphic. Updated: Wednesday, 09-Apr-2008 19:10:22 CDT
Overview | Conv. Outlooks | Watches | MDs | WWA | Reports | Mesoanalysis | Fire
SLGT
MDT
SPC DAY1 CONV OUTLOOK
ISSUED: 2004Z 04/09/2008
VALID: 09/2000Z-10/1200Z
FORECASTER: RACY
National Weather Service
Storm Prediction Center
Norman, Oklahoma
Hazard | Wed (04/09) | Thu (04/10) | Fri (04/11) | Sat (04/12) | Sun (04/13) | Mon (04/14) | Tue (04/15) | Wed (04/16)
Severe | Moderate | Moderate | Slight | No Area | No Area | No Area | No Area | No Area
Fire | Extreme | Extreme | Critical | No Area | No Area | No Area | No Area | No Area
Click on the hazard matrix cell to navigate to the specific forecast.
Other News (Updated: April 04, 2008)
National Weather Service • Since 1870
Moving your mouse over these buttons will provide you with a quick view of the daily threat along with the location of any watches or severe weather reports
This summary box gives you an idea of what the maximum threat for severe weather is across the entire country.

Lightning Safety

National Weather Service www.weather.gov

Lightning Safety

- Lightning strikes the Earth 20 million times per year, on average.
- Most lightning fatalities and injuries occur when people are caught outdoors in the summer months.
- The safest place to remain is indoors and away from windows and electrical appliances
- Avoid being the tallest object, and stay away from other tall objects such as isolated trees.
- If you can hear thunder, you are in danger of being struck by lightning. Take shelter.

Lightning Myths

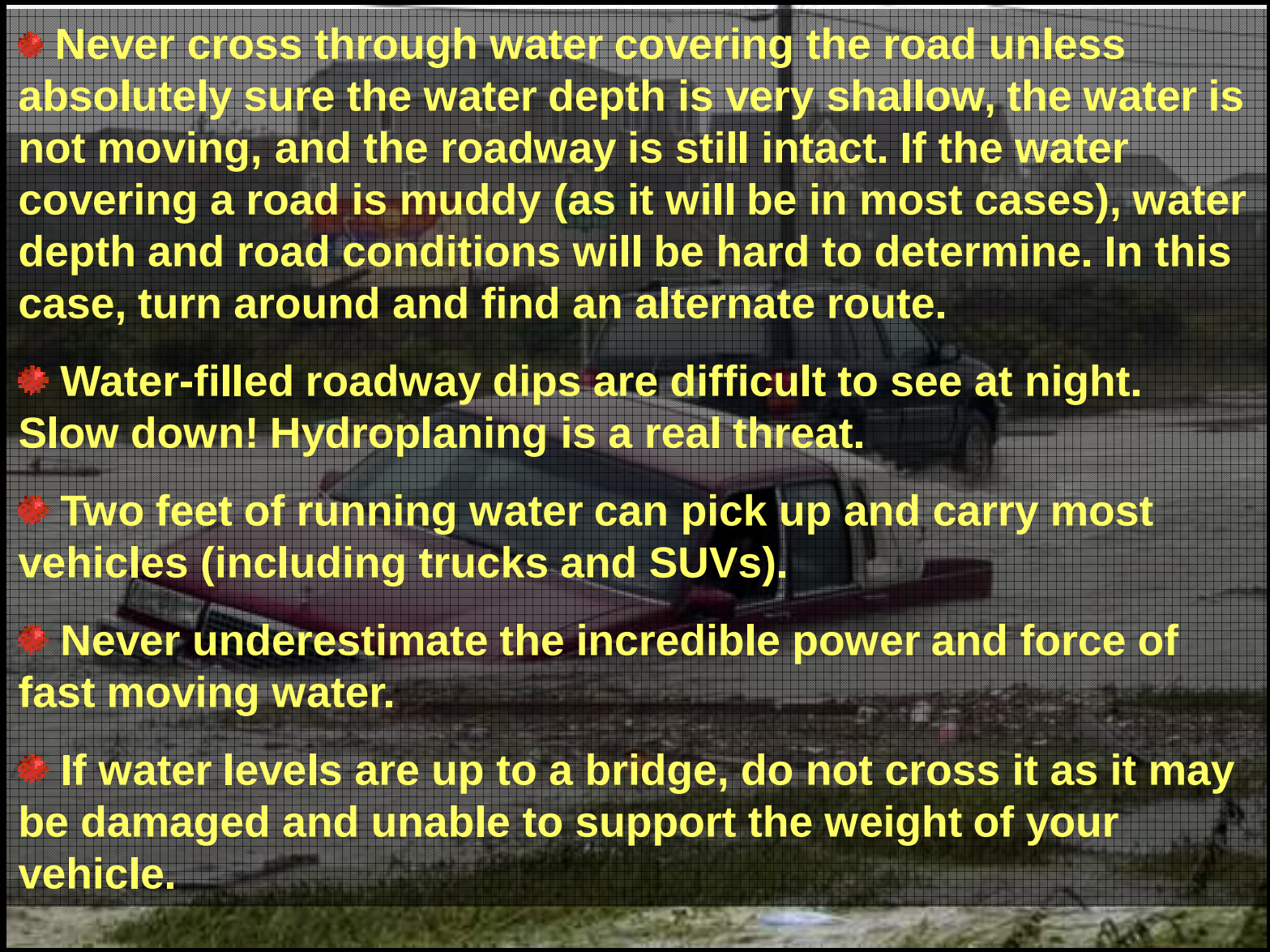
Myth: If it is not raining, then there is no danger from lightning.

Truth: Lightning often strikes out of heavy rain and may occur as far as 10 miles away from any rainfall. (Bolt out of the blue.)

Myth: Tue rubber sole of shoes or rubber tires on a car will protect you from being struck by lightning.

Truth: Rubber-soled shoes or rubber tires on a car provide no protection from lightning. The steel frame of a hard-topped vehicle provides increase protection if you are not touching metal. You are much safer inside an enclosed vehicle than standing outside.

Flood Safety



- Never cross through water covering the road unless absolutely sure the water depth is very shallow, the water is not moving, and the roadway is still intact. If the water covering a road is muddy (as it will be in most cases), water depth and road conditions will be hard to determine. In this case, turn around and find an alternate route.
- Water-filled roadway dips are difficult to see at night. Slow down! Hydroplaning is a real threat.
- Two feet of running water can pick up and carry most vehicles (including trucks and SUVs).
- Never underestimate the incredible power and force of fast moving water.
- If water levels are up to a bridge, do not cross it as it may be damaged and unable to support the weight of your vehicle.

Flood Safety

It may just be a whole lot deeper than what you think!

Remember, boats float, cars don’t.

http://tadd.weather.gov

Don’t risk it and become a statistic

Story County, IA

Spotters Must

- **Know the difference between shear and rotation**
- **Know the difference between a shelf cloud and a wall cloud**
- **Know that funnel clouds usually do not form on a shelf cloud**
- **Know that a low hanging cloud in the shape of a funnel, if not rotating, is NOT a funnel cloud**
- **Know the difference between blowing dust and a tornado**
- **Spotters must not exaggerate their report**

Myths

- **Myth - I heard a loud noise and it sounded like a train…it had to be a tornado.**

Truth - Any very strong wind will make a "roaring" noise or sound like a train – the sound depends on the wind speed, local terrain, obstructions to flow, and atmospheric conditions.

- **Myth - The wind twisted the metal on my shed…the trees that were blown down are twisted…it had to be a tornado.**

Truth - One generally cannot look at any individual object to determine if the damage was caused by a tornado or straight-line wind. The total damage pattern and how the debris is strewn in relation to other debris is a better indicator of the causative effect. A straight-line wind can cause an object to twist as the destructive force of the wind on an object can cause uneven stress loads with different failure points.

- **Myth - Objects like lakes, rivers, and hills protect areas from getting hit by a tornado.**

Truth – Nothing more than folklore. These features provide no protection or have any bearing on the development or movement of a tornado. Some thought tornadoes would not strike the downtown area of a large metropolitan city. Recent tornadoes in downtown Fort Worth, Salt Lake City and Nashville dispelled that myth.

Myths

- **Myth – Mobile homes attract tornadoes.**

Truth – Mobile homes are not more likely to get hit by a tornado. Mobile homes are more likely to sustain damage (compared to a house) if struck by a tornado or strong winds.

- **Myth – It is safe to seek shelter from a tornado under an overpass.**

Truth – Overpasses are not a safe place to take shelter. They can funnel the wind flow and increase the strength of the wind. They do not provide protection from flying debris. In addition, parking your car under or near an overpass creates a hazard to other motorists trying to pass through the area. Virtual traffic jams have been created by motorists gathering under an overpass. See this link for overpass safety.

- **Myth – We should open our windows if a tornado approaches.**

Truth – Stay away from windows if a tornado approaches. If your windows are closed, leave them closed. Your house will not explode due to the decrease in pressure within the tornado. If the tornado is close enough to your house that it experiences a significant and rapid drop in pressure, chances are the wind and debris will have damaged or destroyed your house before the minimum drop in pressure occurred.

We want your storm photos!!

If you have any storm photos or videos that you would like to share with us, please e-mail them to your local NWS. Include your name, date of the photo, where the photo was taken, and a description of the photo. Also indicate if you give the NWS permission to use the photo. We are interested in ALL weather phenomenon and cloud types. The best photos or videos are those taken which show a wide view of thunderstorm structure. Close-ups are good, but they do not allow others to take in the bigger picture (no pun intended). It is this wider perspective that allows others to learn by seeing the structure of a specific phenomenon relative to that of the entire thunderstorm.

Thank you for attending our spotter class!